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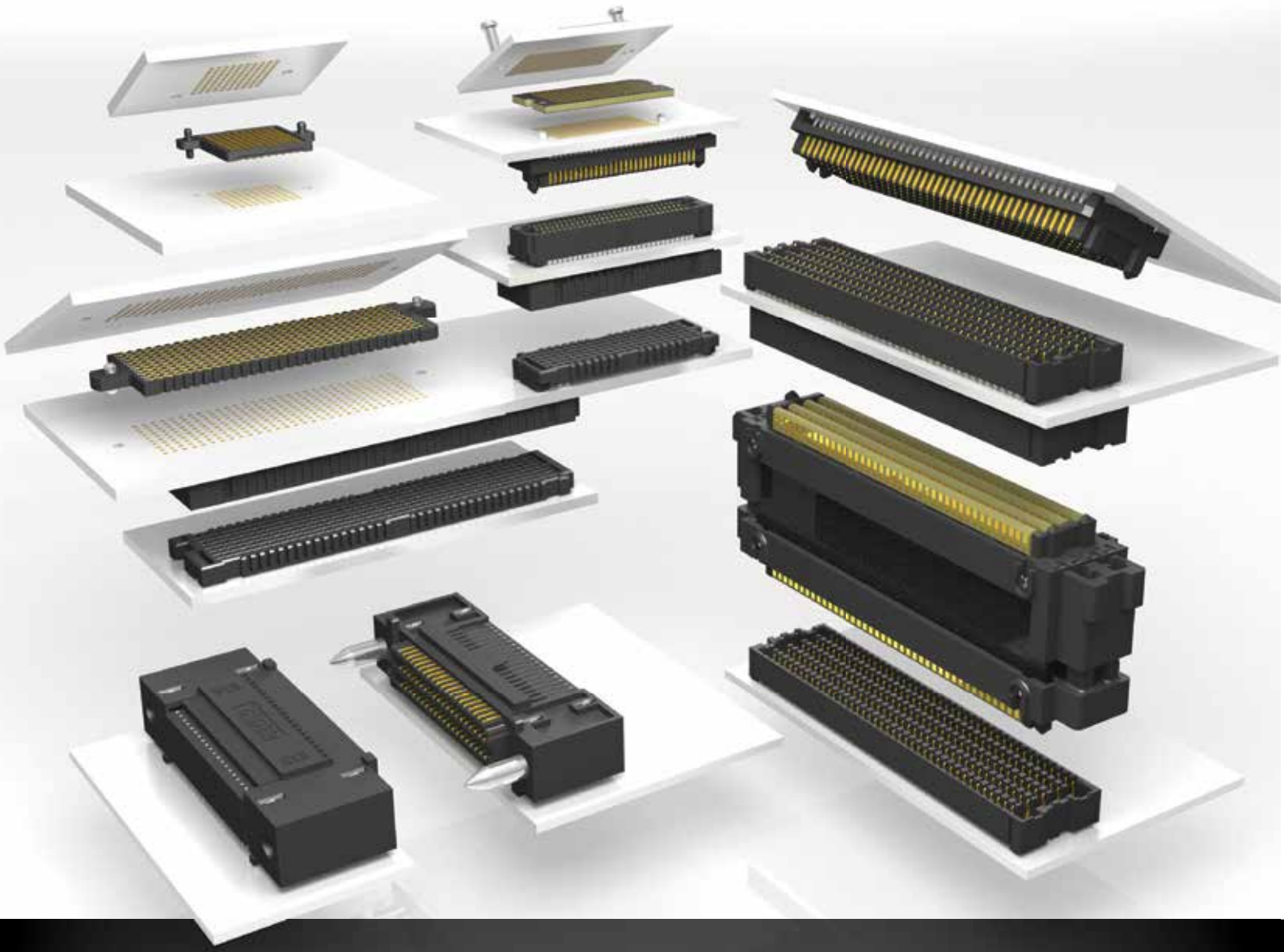

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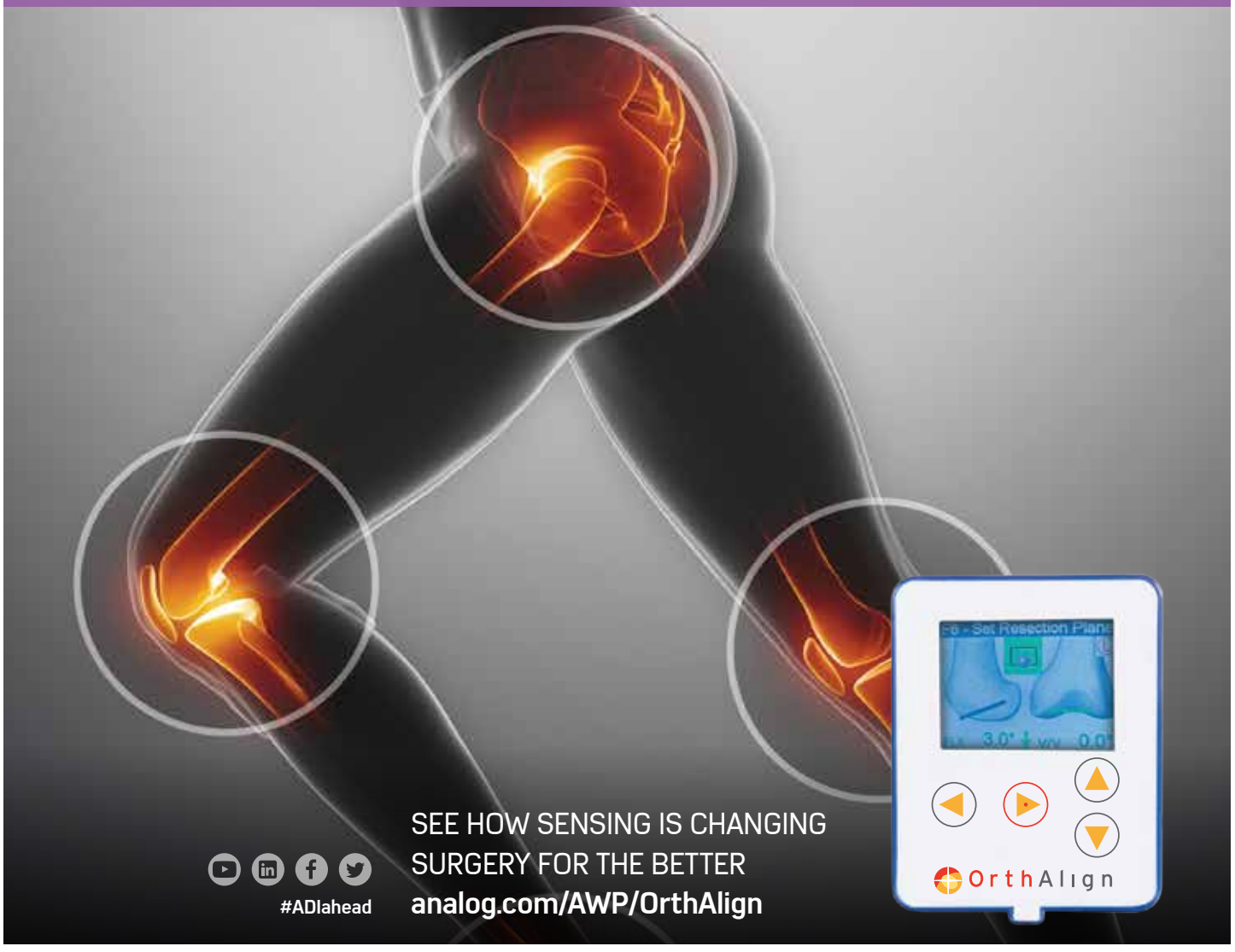

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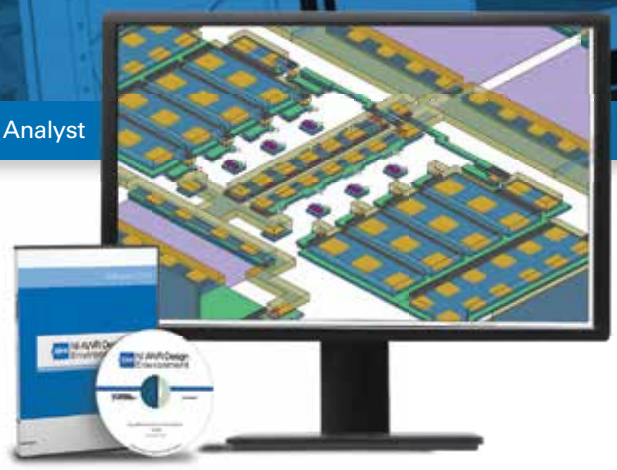

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Read To Lead

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Moreover, as an attractive platform for advertisers from around the world, New-Tech Europe has become a hub for bustling international commercial activity. Here, through ads and other promotional materials, Israeli readers obtain crucial information about developers and manufacturers worldwide, finding the tools, instruments, systems and components they need to facilitate their innovative endeavors.

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Contents

Samsung's New Gear 360 Introduces True 4K Video and 360-Degree Content Capture

Updated Design and Live Streaming Capability Make VR and 360 Content More Accessible and Easier to Share

Samsung Electronics Co., Ltd. today announced a new Samsung Gear 360, a 4K resolution-capable 360-degree camera with a refined design for easier use. With enhanced features for high-quality content, the Gear 360 is lightweight and compact, offering an expanded Samsung VR ecosystem.

"As consumers turn more to video to share their experiences, we want to deliver accessible and innovative products to make digital content easier to create, share and stream," said Younghee Lee, Executive Vice President of Global Marketing and Wearable Business, Mobile Communications at Samsung Electronics. "The updated Gear 360 will continue to expand the horizons of what consumers can experience and share."

Enhanced Features for High-Quality 360 Content Creation

For the first time, the Gear 360 offers 4K video recording for immersive and realistic digital content. Equipped with 8.4-megapixel image sensors and Bright Lens F2.2 on both dual fisheye lenses, the Gear 360 can create high resolution images.

The Gear 360 leverages Samsung's innovative technologies and services to seamlessly share, view and edit content. Whether creating a 360-degree video or still images, users can access various viewing modes, editing tools and photo effects and filters to create customized content. Users can also effortlessly convert 360 videos into standard formats for easy-to-share content.

Always Stay Connected with 360 Social Live Broadcast

The Gear 360 introduces real-time content sharing. When the Gear 360 is synced with a compatible smartphone or computer, the new device enables users to share their best experiences with high-quality live broadcasting or direct uploading to platforms such as Facebook, YouTube or Samsung VR.

Expanded Compatibility for More 360 Experiences

The Gear 360 is compatible with a selection of third-party accessories and mounts. The latest edition of the Gear 360 is compatible with Samsung flagship devices including the newly-released Galaxy S8 and Galaxy S8+, Galaxy S7, Galaxy S7 edge, Galaxy Note5, Galaxy S6 edge+, Galaxy S6, Galaxy S6 edge, Galaxy A5 (2017) and Galaxy A7 (2017). The Gear 360 also offers greater compatibility with iOS devices including the iPhone 7, iPhone 7 Plus, iPhone 6s, iPhone 6s Plus and iPhone SE, as well as Windows and Mac computers.

Pilots begin flights in new F-35 Lightning II simulator in preparation for trials on carrier

A world-leading flight engineering simulator created by BAE Systems is ready to be "flown" by F-35 Lightning II pilots for the first time as they prepare for flight trials on the UK's new Queen Elizabeth Class aircraft carrier next year.

The refurbished simulator will test pilots' skills to the limits as they practise landing on the deck of the new aircraft carrier in a range of difficult sea and weather conditions provided by the simulator.

The bespoke £2M simulator facility offers a 360-degree immersive experience for pilots to fly the jet to and from the UK carrier. It comprises a cockpit moved by an electronic motion platform and a full representation of the ship's flying control

tower (FLYCO), where a Landing Signal Officer on board the carrier will control aviation operations.

The 360-degree view for pilots is vital as potential obstacles on an aircraft carrier are often behind the pilots as they land. Over the coming months the simulator will be used by UK and US military test pilots who have experience of flying F-35s on US carriers.

The pilots will practise thousands of ski jump short take-offs and vertical landings that use both the vertical thrust from the jet engine and aerodynamic lift from the wings, allowing the aircraft to take-off and land on the carrier with increased weapon and fuel loads compared to predecessor aircraft.

Peter 'Wizzer' Wilson, BAE Systems' test pilot for the short take-off and vertical landing variant on the F-35 programme, said the simulator trials will provide engineers with the data to begin flight trials on HMS Queen Elizabeth, the First of Class aircraft carrier in 2018.

He said: "The immersive experience is as near to the real thing as possible. The data will show us exactly what will happen when F-35 pilots fly to and from the Queen Elizabeth carriers. The trials we can run through the simulator are far more extensive than what we will do in the actual flight trials because we can run and re-run each trial until we have all the data we need. The simulator provides greater cost efficiency for the overall programme and is extremely important to the success of the first flight trials."

Over the last 15 years, BAE Systems' flight simulation has been used to support the design and development of the interface between the F-35 and the UK's next generation of aircraft carriers.

The new simulator replaces a previous version which was first built in the 1980s to develop technology for the Harrier jump-jet and the Hawk advanced jet trainer before being converted for F-35.

Qualcomm Snapdragon 835 Mobile Platform Powers Gigabit LTE and Immersive Experiences on Samsung Galaxy S8

Qualcomm Technologies, Inc., a subsidiary of Qualcomm Incorporated (NASDAQ: QCOM), today announced that its premium mobile platform is powering Samsung's latest and most sophisticated flagship smartphone, the Samsung Galaxy S8, for select regions. The Samsung Galaxy S8 is powered by the Qualcomm® Snapdragon™ 835 Mobile Platform, featuring the first commercial SoC manufactured using 10nm FinFET technology, and which integrates the Snapdragon X16 LTE modem. This powerful platform allows the Galaxy S8 to support Gigabit LTE, for fiber-optic Internet speeds on the go, and more consistent mobile data performance in more places. The Galaxy S8 is the first smartphone to feature Qualcomm® TruSignal™ adaptive antenna tuning technology for carrier aggregation, designed to deliver a more consistent voice and data experience, indoors and outdoors. The Snapdragon 835 is roughly 35 percent smaller in package size and consumes roughly 25 percent less power compared to the previous generation flagship processor, which equates to longer battery life and a thinner design. The processor also supports next-generation immersive entertainment experiences, such as mobile virtual reality (VR), with leading edge still and video capture.

"We are proud to continue our long and productive collaboration with Samsung to help bring the most advanced mobile experiences, such as Gigabit LTE and mobile VR, to consumers with the new Samsung Galaxy S8," said Alex Katouzian, senior vice president and general manager, mobile, Qualcomm

Technologies, Inc. "Featuring a thin and light design with superior battery life, immersive multimedia, and exceptional photography with Gigabit LTE speeds, the Samsung Galaxy S8 powered by the Snapdragon 835 Mobile Platform delivers the experiences today's mobile users demand."

The Snapdragon 835 Mobile Platform offers improved processing power and performance with the new Qualcomm® Kryo™ 280 CPU and Qualcomm® Hexagon™ 682 DSP, and is designed to simultaneously meet the high performance demands, thermal limits and power efficiency constraints of the next-generation VR designs, like the Samsung Gear VR for Galaxy S8. Snapdragon 835 delivers up to a 25 percent increase in 3D graphics rendering performance with the Qualcomm® Adreno™ 540 GPU compared to Adreno 530. Snapdragon 835 also supports object and scene-based 3D audio as well as visually immersive 4K Ultra HD premium (HDR10) video, that enables the Samsung Galaxy S8 to play HDR movies and other types of videos from major content publishers. At the core of the capture experience is the Qualcomm Spectra™ 180 ISP, featuring dual 14-bit ISPs that support the Galaxy S8 8MP front camera and 12MP rear camera for the ultimate photography and ultra-high definition videography experience. Both still and video capture experiences are enhanced with advanced auto-focus technologies along with HDR true-to-life colors and perceptual quantization video encoding. The Snapdragon 835 also features the Qualcomm Haven™ security platform with enhanced security for biometrics and device attestation, which can be experienced in the Galaxy S8. The Galaxy S8's signal performance, power efficiency and thermal performance are enhanced by an advanced RF front-end which includes Qualcomm Technologies' envelope tracker, impedance tuner, diversity receive modules, aperture tuners, low-noise amplifiers, extractor and BAW filter.

"We value the long history of collaboration that we share with Qualcomm Technologies, and are excited to work with them on the Galaxy S8, the mobile industry's first smartphone based on 10nm FinFET process technology to be available to consumers," said Robert Kim, vice president, product strategy team, mobile communications business, Samsung Electronics. "Doing so provides our customers with a best-in-class mobile experience, which includes the most advanced features in connectivity, immersion, machine learning and security."

More information on the Snapdragon Mobile Platform can be found at https://www.qualcomm.com/products/snapdragon/processors/835. For more information about the Samsung Galaxy S8, please visit www.samsung.com/galaxyor www.samsungmobilepress.com.

Emission-free delivery vehicles for the courier service: Strategic partnership: Hermes to deploy 1500 Mercedes-Benz Sprinter and Vito with electric drive

Hermes and Mercedes-Benz Vans have agreed on a wide-ranging strategic partnership to electrify the courier service's vehicle fleet. The companies are to start using battery-electric vehicles in the logistics provider's normal operations in a pilot phase in Stuttgart and Hamburg in early 2018. The focus will be on the economy, sustainability and practicality of emission-free delivery vans when used for the last mile. By the end of 2020, Hermes Germany intends to deploy 1500 Mercedes-Benz Vito and Sprinter electric vans in urban areas across Germany.

"Electric drive is a key technology for urban transport – especially in commercial use. Last-mile deliveries must become more efficient and – in specific applications – emission-free. Last year, we announced that we will put a Mercedes-Benz electric van into series production again; our first one was in 2011. We are proud that we can already announce that Hermes will be our first customer – and with a significant number of vehicles at that. This is a specific implementation of our plans for tailored industry solutions in cooperation with our customers. Hermes requires mid-size and large vans with electric drive for its applications. We can meet both needs with high-quality, reliable and safe vehicles that set high standards also in terms of driver ergonomics", stated Volker Mornhinweg, Head of Mercedes-Benz Vans.

The partners have set themselves the goal of improving efficiency, productivity and sustainability in parcel deliveries. This has been partially triggered by the rapid growth in online retailing and the resulting challenges for courier-express-parcel

(CEP) companies. Another aim is to generate and implement ideas that improve service quality for the customers. With the help of quiet, locally emission-free vehicles, Mercedes-Benz Vans and Hermes Germany want to make a lasting contribution to optimizing urban delivery transport. By the year 2025, Hermes plans to carry out deliveries in the inner-city areas of all major German cities completely free of emissions. Solely electricity from 100 percent regenerative energy sources will be used to charge the electric vehicles' batteries. The electricity will be generated with a completely neutral effect on the climate and, accordingly, in line with the green-electricity label "Grüner Strom" from the environmental associations.

One special focus is on the technical feasibility and economic efficiency of battery-electric vehicles in the CEP industry. New concepts are to be developed for the integration of battery-electric vans – including the required charging infrastructure – into existing operational processes.

Another crucial driver of efficiency improvements is the development of system solutions in the vehicle and beyond that are optimally adapted for the specific applications. In the context of the strategic partnership with Hermes, Mercedes-Benz Vans will thus also implement connected services – for example, services that facilitate optimal route planning with the use of information on the vans' batteries and remaining range. The van producer will also contribute intelligent cargo-space solutions and innovative mobility services to the partnership. These will include new kinds of leasing offers and short-term rentals for contractual partners of Hermes.

For over 40 years now, Hermes and Daimler have had a growing partnership mainly based on conventional vehicles but also with a long tradition in the research and development of alternative drive systems. That goes back to the nineteen-nineties and tests of the very first van on the market powered by hydrogen. In 2001, Hermes tested a Mercedes-Benz Sprinter with fuel-cell technology in normal operating conditions. In 2011, the Hamburg-based logistics provider deployed the first series-produced electric vehicle from Mercedes-Benz Vans, the Vito E-CELL. The two companies also cooperate on vehicles above 3.5 tons. Together with Hermes and the city of Stuttgart, Daimler is currently performing a fleet test with five battery-powered Fuso Canter E-CELL vehicles in urban distribution transport. The test started in April 2016.

With its further intensified partnership with Mercedes-Benz Vans, Hermes Germany is pushing forward the implementation of an ambitious masterplan for the systematic reduction of CO2 and particulate matter in the delivery sector. Hermes Germany sees it as part of its business responsibility to expand its pioneering role with regard to socially and environmentally compatible transport. The climate strategy of the parent company, Otto Group, aims to reduce group-wide CO2 emissions by at least half by 2020. More than 30 individual projects in the Hermes "WE DO!" campaign are contributing to the achievement of this goal.

Nano Dimension Supplies 3D Printer to International Defense Solutions Provider

Nano Dimension Ltd., a leader in the field of 3D printed electronics (NASDAQ, TASE: NNDM), announced today that its wholly owned subsidiary, Nano Dimension Technologies Ltd., has supplied its flagship DragonFly 2020 3D Printer to an international company that provides solutions for the defense industry. This customer joins the growing ranks of Nano Dimension's beta customers.

Nano Dimension's beta program involves the delivery of the company's DragonFly 2020 3D Printers to leading companies and partners worldwide through a leasing model. These customers are pioneering additive manufacturing technology and techniques for electronics and circuitry, and are active in a variety of industries, including: defense, consumer goods, technology for the finance industry and medical devices. The customers will qualify the DragonFly 2020 technology and will use it to speed up their product development cycles. The DragonFly 2020 3D printer also allows them to strengthen their in-house innovation capabilities, while providing them with enhanced R&D IP security. In return, companies make payments on their leases and provide Nano Dimension with valuable feedback for further product development.

EMBEDDED WORLD2017

- New milestone: more than 1,000 exhibitors for the first time
- Over 30,000* high-calibre trade visitors once again
- Growth in conference delegate numbers

2017 embedded award recognises pioneering innovations

Following its 15th round, embedded world has once again impressively reinforced its status as the No. 1 international gathering for the embedded system technology sector. In 2017 it again reported significant increases in all important exhibition-specific KPIs and broke new records after three exciting, action-packed days of trade fair and congresses. More than 30,000* trade visitors – including an international contingent of 38% – came to Nuremberg for an event that reached new heights with more than 1,000 exhibitors (+8%) from 40 countries. The professional community was equally impressed by the concurrent embedded world and electronic displays conferences: 1,796 embedded and display experts from all over the world (+8%) travelled to Nuremberg to enjoy professional dialogue and knowledge-sharing.

"These results from the 15th round of embedded world show that it is absolutely the No. 1 event for the international embedded sector. On the occasion of this small anniversary, the event not only increased in display area (up 8%) but also passed a new milestone for exhibitor participation, breaking the four-digit barrier with 1,017* exhibitors from 40 countries. But the 30,017* trade visitors from all over the world also highlight the importance of the event for the embedded community. "We are very pleased that the event has grown yet again, especially in respect of the number of international exhibitors and visitors," says Richard Krowoza from the NürnbergMesse Management Team.

Highly satisfied exhibitors at embedded world 2017

This year too, the mood in the halls was excellent and both exhibitors and trade visitors were very satisfied with the event they call their own. Both groups benefited from the professional dialogue with one another and a number of new projects were instigated. All of this is also confirmed by our exhibitor poll,in which nine out of ten participating companies rated the event a success. Based on this upbeat mood and the results at their stands, equally as many companies said that they would be exhibiting again in 2018. Around nine out of ten expect follow-on business from the event and 94% were able to forge new business contacts. In addition, 95% confirmed that they managed to reach their target groups.

Trade visitors happy to recommend embedded world

"On this its 15th appearance the embedded world event continued to impress trade visitors. You















could really feel the fantastic atmosphere in the halls. And this is again illustrated very clearly by the visitor survey conducted by an independent institute," explains Benedikt Weyerer, Director Exhibitions, NürnbergMesse. Almost without exception, trade visitors were satisfied with the content of the event and range of products on display. Nine out of ten of the 30,017 trade visitors are involved in the procurement decisions of their companies. This is further evidence of the great importance of the fair for the embedded community. No less than 86% would recommend visiting embedded world to their business contacts and colleagues, while 97% stated even before the fair was over that they would be visiting embedded world again in 2018.

Focus of embedded world conference on IoT and Security & Safety

The theme of the embedded world conference was "Securely Connecting the Embedded World". As well as the two main thematic focus areas "Internet of Things" and "Security & Safety", the programme included another four conference clusters: "Software & Systems Engineering", "Hardware Engineering", "Embedded OS" and "Management Focus". The individual clusters were made up sessions and classes and so allowed participants to choose between highly topical, practice-based content or technically sophisticated tutorials devoted to exploring an issue in greater depth. The keynotes addresses were given by Mathias Wagner, Chief Security Officer, NXP and Riccardo Mariani, Chief Functional Safety Technologist, Intel.

"In numerous conversations with conference delegates and company representatives the great importance attached to the embedded world exhibition and conference was confirmed again and again. Visitors and conference delegates take home ideas, practical solutions and inspiration that put them in a favourable position to tackle the tasks ahead of them," says Professor Matthias Sturm, Chair of both the Advisory Committee of embedded world and the Steering Board of the embedded world conference.

The electronic displays conference also grew again this year and provided the professional community with all relevant information about displays for developers, users and decision-makers. For example, internationally renowned experts held keynote presentations on new approaches in display technology as well as market and technology trends. Other thematic focus areas and highlights of the conference included success factors for displays in automotive applications, OLEDs, AR/VR and the latest trends in touch screens. Sessions on topics like display measuring technology, interfaces and display optimisation provided a fitting complement to the programme, while the regular author interviews after each session offered a great opportunity to discuss the presentation content in a small group setting.

Interesting discussion forums with insights into the future

At the second round of 'Safe for the Future', the protection of critical infrastructures was discussed by: Daniel Cooley, Senior Vice President and General Manager of Silicon Labs, Professor Christof Paar, Department for Embedded Security at Ruhr University Bochum and Bernd Kowalski from the German Federal Agency for IT Security (BSI). The discussions were moderated by Professor Axel Sikora, Member of the Steering Board for the embedded world conference and Scientific Director of the Institute of Reliable Embedded Systems and Communication Electronics at Offenburg University of Applied Sciences

The discussion panel "Embedded vision - the 'next big thing'?" made its debut this year. Already an established issue for the mechanical engineering sector, this was an interesting topic for the embedded community. What is merely wishful thinking and what is a reality? High-calibre representatives from the traditional image

processing and embedded communities joined with users to discuss the latest developments, opportunities and challenges of embedded vision. There were responses from Richard York, Vice President Embedded Marketing, ARM Ltd., Arndt Bake, Chief Marketing Officer, Basler AG, Jeff Bier, founder of the Embedded Vision Alliance, Olaf Munkelt, Managing Director, MVTec Software GmbH, Markus Tremmel, Driver Assistance Systems Chief Expert, Robert Bosch GmbH and Nick Ni, Senior Product Manager, EmbeddedVision and SDSoC, XILINX.This event resulted from a collaboration between the VDMA IBV (German Mechanical Engineering Industry Association) and NürnbergMesse.

embedded award 2017: innovation, innovation, innovation

For the 13th time, the embedded award has recognized products that make a special contribution to the progress of the entire sector of embedded systems and IoT. The coveted accolade was awarded in the categories hardware, software and tools during the press tour of embedded world 2017. The awards were presented by Dr Roland Fleck, CEO of NürnbergMesse and Professor Matthias Sturm, Jury Chair and Chair of the Advisory Board of embedded world.

And the winners are:

next system with HapticTouchTM in the hardware category

PROVE&RUN with its ProvenCore-M in the software category

MathWorks with HDL Coder Native Floating Point in the tools category

Simplify and Improve The Performance of Ultrasonic Medical Imaging Systems Using a Multi-Channel Digital Demodulator

› Hugh Yu, Gina Kelso, Ashraf Saad - Analog Devices, Inc.

Abstract

A design based on digital demodulator and JESD204B interface for multiple channel ultrasound receive systems is introduced. The design reduces the data rates and simplifies board routing between the Analog Front End (AFE) and digital processing circuits up to 80%. In addition, the ultrasound system can achieve more design goals, such as utilization of cheaper and less computationally efficient Field Programmable Gate Arrays (FPGA), a software-based beam-former, and higher order multiline processing for real-time 4D and advanced imaging modes.

Introduction

Ultrasonic imaging systems designers must continuously struggle to meet the demand for ever-higher image quality being made by users throughout the medical diagnostics field. One of the key techniques for image quality improvement is to enhance the signal-to-noise ratio of the receiving channel. As the number of receiving channels in a system doubles, the signal-to-noise ratio should improve by 3 dB in theory. Therefore, increasing the number of system channels has become the easiest and most effective method to strengthen the signal-to-noise ratio.

At present, 128-channel has successfully become the mainstream configuration for middle to high level medical ultrasound equipment, and 192 or more channels will become the next trend for premium systems. With the increase of number of the channels, the data rates between the analog front end (AFE) and back end digital processing section grow proportionally. Higher channel counts also create similar growth in the number of digital circuit device interfaces, the processing power, the costs, and the design complexity of the entire receiver circuit. For example, most ultrasound imaging systems use Radio Frequency (RF) beamforming techniques where the output data rate is entirely determined based on the resolution, sampling rate, and channel numbers of the analog-to-digital converter (ADC). Meanwhile, the Analog Front End (AFE) usually uses Low-Voltage Differential Signaling (LVDS) output

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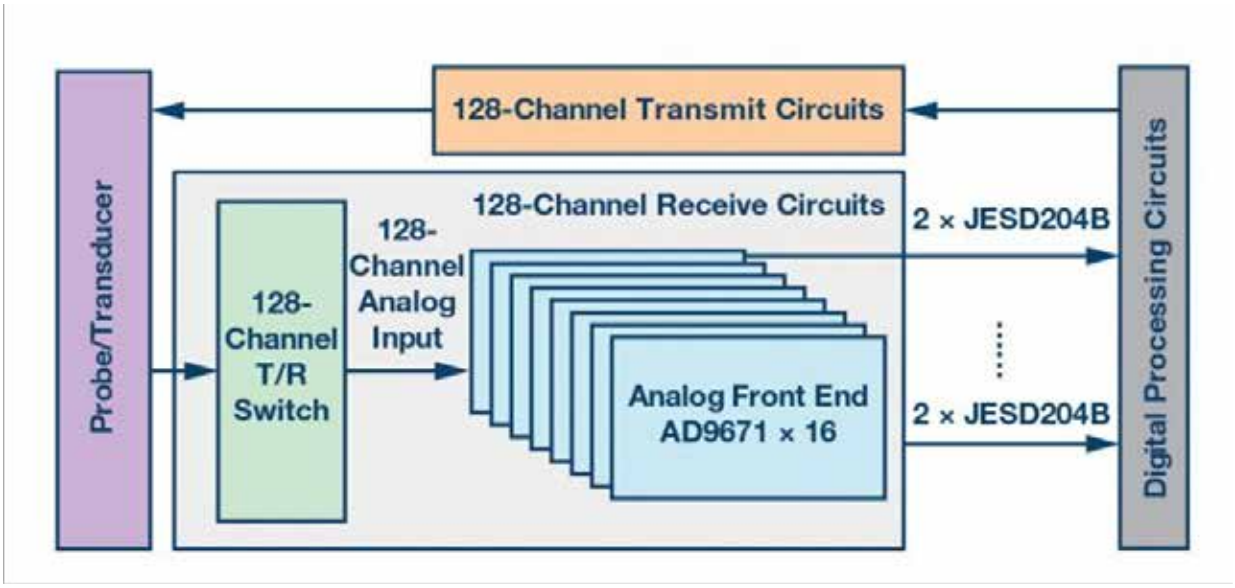

Figure 1. 128-channel ultrasound system block diagram

interfaces. An octal AFE requires 8 pairs of LVDS data wires plus a pair of data clock and frame clock each. For a system with over 128 channels, there are significant amounts of data and physical connections.

This paper introduces an ultrasound receiving channel design solution based on an octal AFE with digital demodulator interface with ADI's JESD204B being used as an example. Using this approach effectively resolves the design difficulties caused by the large data rates and complex physical connections of the system as mentioned above.

System Architecture

An ultrasound system is composed of a probe (transducer), transmitting circuit, receiving circuit, back end digital processing circuit, control circuit, display module, etc. Figure 1 is the block diagram of a 128-channel ultrasound system transmit/receive path with JESD204B interface.

The digital processing module usually comprises a Field Programmable Gate Array (FPGA) which generates the corresponding waveforms according to the current configuration and control parameters of the system, and the transmit circuit's driver and the high-voltage circuit then generate a high voltage to excite the ultrasound transduces. The ultrasound transducer is usually made of Piezoelectric Ceramic Transduce (PZT). It converts a voltage signal into an ultrasound wave that enters into the human body while receiving the echoes produced by the body's bone and tissue.

The incoming echoes are converted into a voltage signal and transmitted to a transmitting/receiving (T/R) switching circuit. The primary objective of the T/R switch circuit is to prevent the high-voltage transmit signal from damaging the low-voltage receive analog front end. The incoming analog voltage signal is amplified and subjected to signal conditioning and filtering before being passed to the AFE's integrated ADC where it is converted into digital data. The digitized signal is then transmitted through a JESD204B interface to the back end digital parts for the corresponding processing to eventually create the ultrasound image. The receiving channel is composed of a 128 channel T/R switching circuit, 16 octal channel ultrasound AFE elements with a digital demodulator and an FPGA with an JESD204B interface.

Octal Ultrasound AFE with Digital Demodulator and Interface

The AD9671 octal ultrasound AFE with digital Demodulator and JESD204B interface from Analog Devices (ADI), form the basis of this ultrasound system receiving circuit. It contains eight Variable Gain Amplifier (VGA) channels with a Low Noise Amplifier (LNA), a Continuous Wave (CW) harmonic rejection I/Q demodulator with programmable phase rotation, an Anti-Aliasing Filter (AAF), a 14-bit ADC, a digital demodulator and

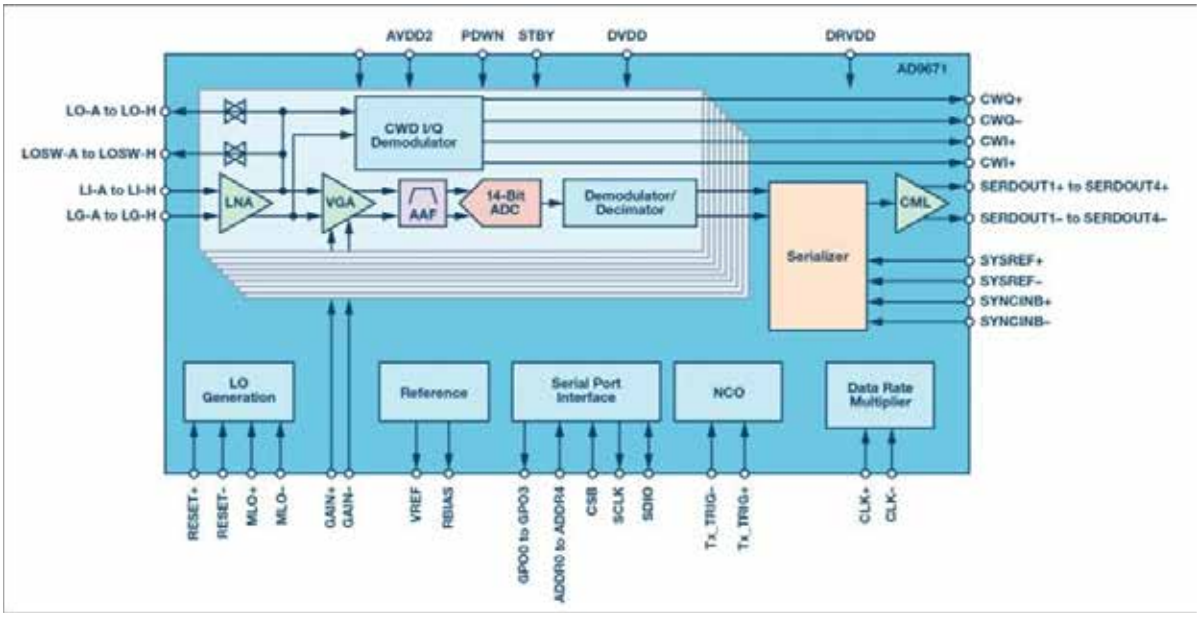

Figure 2. AD9671 functional block diagram

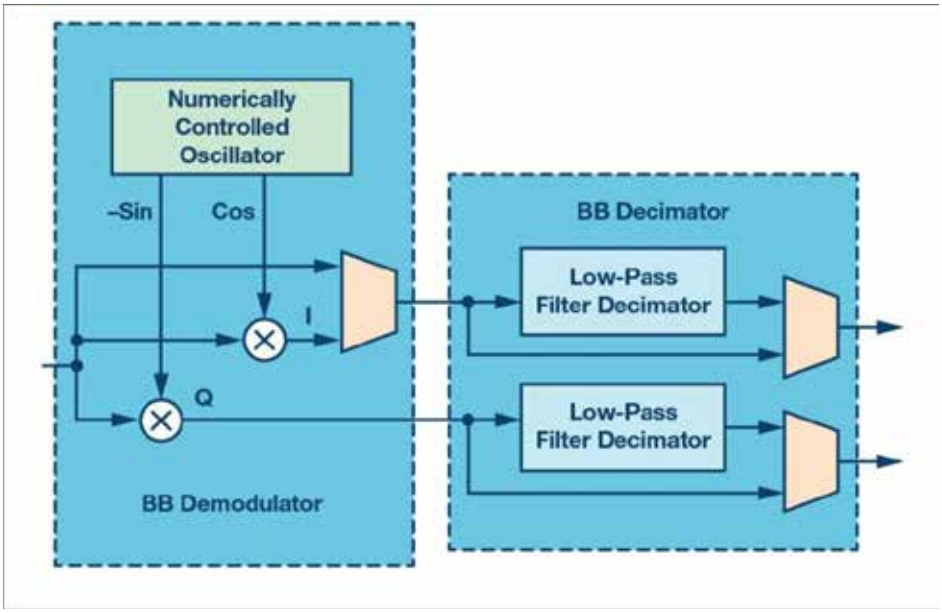

Figure 3. Digital demodulator block diagram

decimator for data processing and bandwidth reduction, and JESD204B interfaces. Figure 2 is a functional block diagram of the AD9671.

The digital demodulator is composed of a baseband demodulator and baseband decimator. The demodulator down converts the RF signal to a baseband quadrature signal. The excess oversampling is reduced by the decimator. Figure 3 is a block diagram of a digital demodulator.

Interface

The AD9671 digital output complies with the JEDEC Standard JESD204B, Serial Interface for Data Converters. The AD9671 supports single, dual, or quad lane interfaces. It can connect to an FPGA with a maximum data output rate of 5.0 Gbps.

System Design and Application

The receiving circuit design of the AD9671 multi-channel ultrasound system is introduced in this section and the benefits of using digital demodulators and the JESD204B interfaces for the system are analyzed further.

Receive Circuit Design

A 32 channel receive circuit module schematic top diagram is shown in figure 4, which can be designed to verify the feasibility of the system based on the AD9671. With four

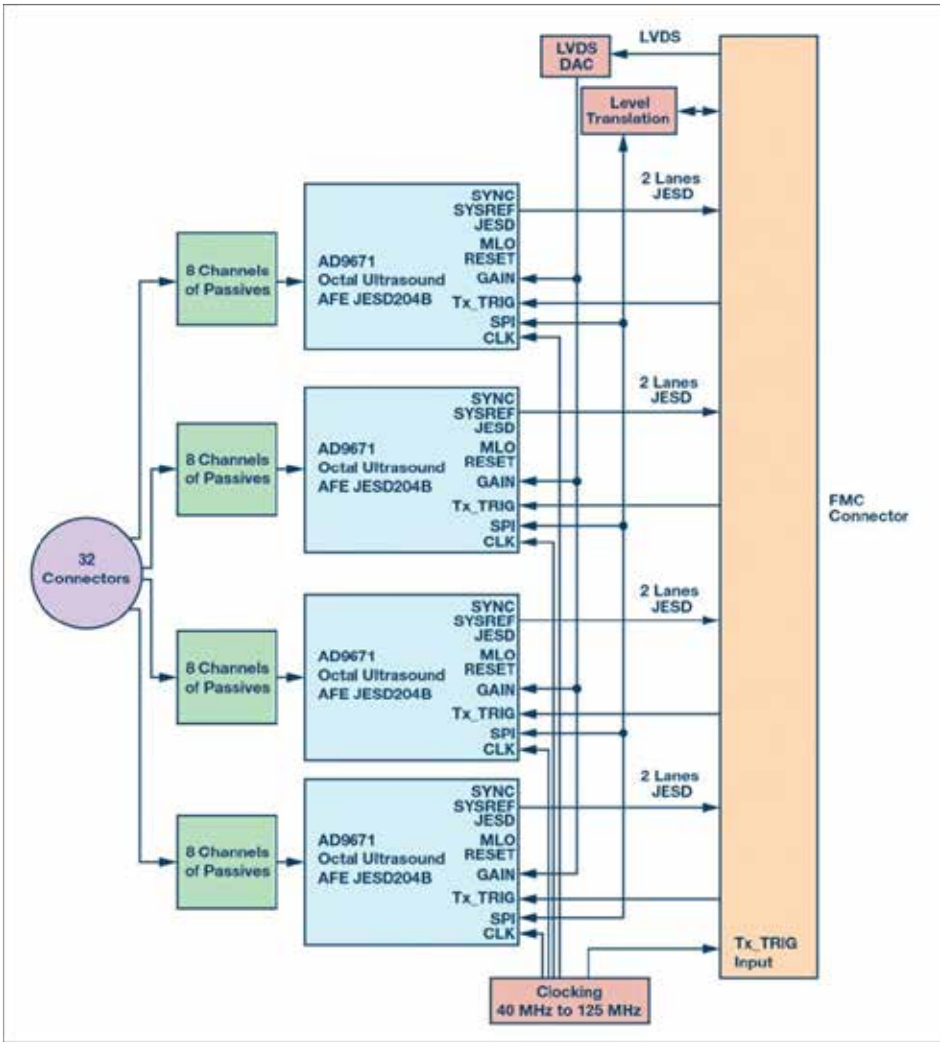

Figure 4. Top-level schematic diagram of the receiving circuit

such modules, a 128 channel receive circuit of an ultrasound system can be configured. This module can be used to perform data capture and processing as well as achieve ultrasonic signal processing and image generation by connecting to an FPGA through a dedicated FMC connector.

Digital Demodulator Application Analysis

For a 128 channel ultrasound system, if a 14-bit ADC is utilized with a sampling rate of 40 MSPS, and an RF beamforming algorithm is used, then, the data rates between the ADC output and the beamforming FPGA is 14 * 40 * 128 = 71.68 Gbps.

The benefits of using a digital demodulator are analyzed below.

The baseband demodulator of the RF signal performs quadrature demodulation. It can be achieved by multiplying the digitized RF signal outputted by the ADC with a complex sinusoidal signal , where is the demodulation frequency that can be close to the center frequency of the ultrasound transducer to down-convert the center frequency to around 0 Hz. The output signal is a complex signal that is represented by its I (In phase) and Q (Quadrature phase). The center frequency of the probe and all of the interested frequency bands signals are down shifted to approximately 0 Hz, the unwanted frequency components are filtered out with the filters and decimator to retain the band information that is useful to generate the ultrasound images.

For a probe transducer with a center frequency of 3.5 MHz, after baseband demodulation and decimation, with 16-bit format I and Q data output, the data rate is now 2 (I&Q)* 16-bits * 3.5 MHz* 128 channels = 14.336 Gbps. Compared to the original 71.68Gbps, the data rate is decreased by 80% even with the I and the Q channels outputting simultaneously.

Interface Application Analysis

In terms of current AFE and ADC in multi-channel ultrasound system applications, LVDS has replaced the parallel output interface. However, for the 128-channel or higher ultrasound system, the large amounts of LVDS wire connections for the ADC output is still a headache for the design engineers. With LVDS, there are 10 pairs of wire for one octal AFE in a current ultrasound system. For a 128-channel ultrasound system, 128/8*10=160 pairs of LVDS data and clock wires are required to be connected to the FPGA.

The benefits of using the JESD204B interface are analyzed below.

As the JESD204B uses a 16-bit digital output format and uses 8B/10B encoding, the output data rate for an octal AFE with 14-bit resolution, 40 MSPSADC the sampling rate is 20*40*8=6.4Gbps. The maximum data rate of each lane of the AD9671 JESD204B interface is 5.0 Gbps, so only 2 pairs of data lane are needed to implement an 8 channel AFE data output. So for a 128-channel ultrasound system, only 128/8*2=32 pairs of output data lanes are required as compared to 160 pairs of the LVDS wires; 80% of the physical interface routing is eliminated.

Conclusion

A multi-channel ultrasound system design based on AD9671, an octal AFE with digital demodulator and JESD204B interface, is introduced in this article. The application advantages and benefits of using such an AFE with digital demodulator and JESD204B interface in an ultrasound system are effectively analyzed respectively. Comparing with most of current RF beamforming and LVDS interface based designs, both the data rate and interface routing between the analog front end and digital processing parts are reduced 80%. If the two methods are combined together in an analysis, the physical connections would be reduced even further. Therefore, the system design presented in this article can effectively simplify the circuit design and software processing complexity by reducing the required board area for data interface routing, the computational complexity requirement, as well as the system design costs.

References

1. Analog Devices Inc. JESD204B Octal Ultrasound AFE with Digital Demodulator, AD9671 datasheet, http://www.analog.com/media/en/technical-documentation/data-sheets/AD9671.pdf.
2. Saad Ashraf, AD967x Digital Processing Overview and System Consideration. Analog Devices Inc., 2012.
3. JEDEC Standard, Serial Interface for Data Converter, JESD204B (July 2011), JEDEC Solid State Technology Association, http://www.jedec.org/.

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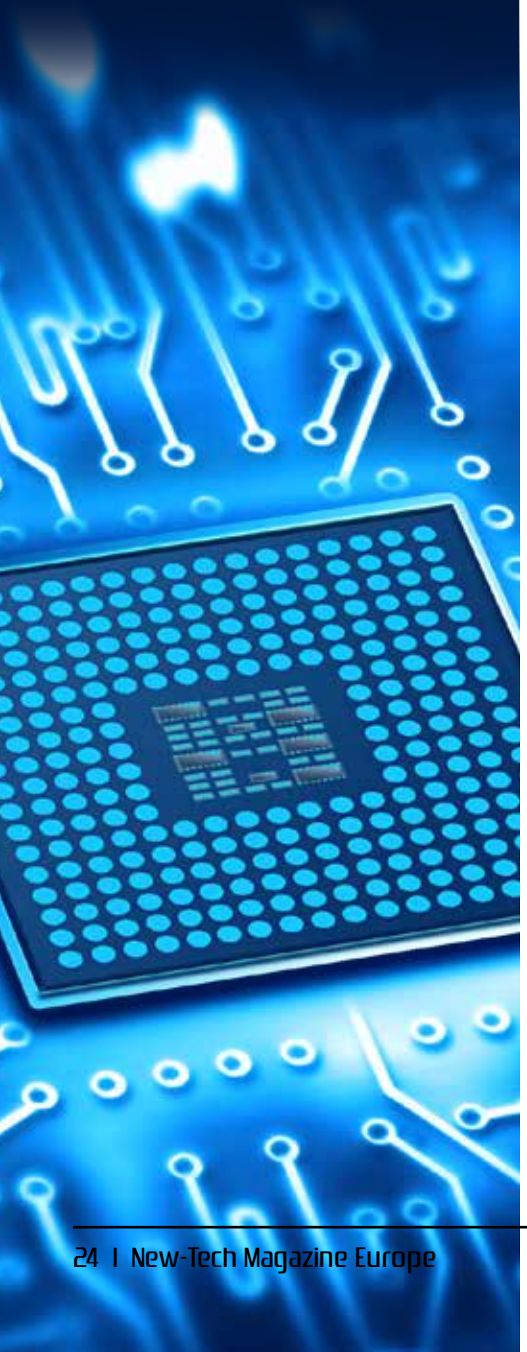

I met Frank Hansen - Regional Vice President Central & East Europe, Avnet Silica, Yulia Milshtein – Director of Operations and Business Development, Avnet ASIC and Pavel Vilk - Director of Engineering, Avnet ASIC, at Embedded World 2017 for a conversation about AVNET and their activity.

ASIC activity in Avnet Silica

Yulia: "Avnet ASIC Israel (AAI) is a fully owned subsidiary of Avnet, providing ASIC design and manufacturing services. ASIC abbreviation stands for Application Specific Integrated Circuit, it is a technology and methodology that enables customers an optimized and unique solution, designed specifically for them and owned by them. This solution is very attractive mainly to volume customers, due to initial NRE investment. ASIC solution is optimizing the unit price, area and power. We are the ASIC veterans of the Israeli market for over 30 years, with 350 successful projects; many of them include mass production. In few last years ASIC is becoming a strong trend, completely "re-inventing itself" almost a "must" of a certain markets, such as Automotive, Wearables and IoT in general, Medical, Industrial, end of life and many more markets that need low power, enhanced performance or that are highly cost sensitive. Avnet management recognized the opportunity in offering the ASIC Services across Europe, and decided to scale up the activity. Today, every Technical Sales person in Avnet can offer his customer ASIC full turnkey solution as part of the line card. This service perfectly complements the ASSP and FPGA offering of Avnet."

Avnet Silica & ASIC

Frank: "In the Embedded World fair we introduce the ASIC team to the European market. I feel that the connection between Avnet Silica & ASIC is very strong. We also see a lot of customer opportunities for ASIC in central Europe".

AAI offering

Yulia: "AAI is a service company; we don't compete with our customers. Our purpose is to enable the fastest and most robust pass for the customer to mass production. We offer a holistic solution: from customer concept or spec all the way through architecture, logical design, IP selection and integration, including strong Analog capability, emulation and backend design. On the manufacturing side, we offer full productization and production management cycle: package development, test program and hardware development, prototype bring up and porting to mass production site, qualification and mass production management (independently or through Avnet channel). Customer can give us an RTL or alternatively his FPGA code or his board design and we will send a tested chip to his end customers. Ours design team is comprised of proficient and knowledgeable ASIC, system/CAD and analog engineers, who have expertise in all aspects of Architecture, ASIC, analog, FPGA designs and implementation. The Design Center, fully equipped with state-of-the-art CAD tools and infrastructure. We have an access to a broad range of advanced technologies for ASIC manufacturing, (0.18µm-14nm, low leakage, automotive process, embedded flash, special processes for sensors, SiGe etc.) We offer one stop shop from concept to tested chip."

Trends in ASIC markets

Pavel: "Being a CUSTOM solution, and APPLICATION AGNOSTIC, the ASIC technology enables us to optimize our system in a wide range of applications in todays' hot markets. As well, the

left to right: Pavel Vilk - Director of Engineering, Avnet ASIC; Frank Hansen - Regional Vice President Central & East Europe, Avnet Silica; Yulia Milshtein - Director of Operations and Business Development, Avnet ASIC; Yair Sahar - Technical Team Nanager, Avnet Israel

markets today require very small footprint, low power and low cost unique and secure systems, and the ASIC is the best choice for these applications.

- Automotive and ADAS car systems, Infotainment and Connected Car
- Wearables and Hand-Held devices
- IoT devices (sensors, metering, etc.)
- Consumer products (AR/VR, Drones, Gesture Recognition)
- Industrial Applications (Robots, Valve Control, Vision systems)
- Bio Medical (Attached to Body or Wrist, Implantable sensors and broadcasters) ".

ASIC decision points

I asked Pavel - What are typical conditions to start ASIC project? When should customer ask himself about ASIC? His answers were: "It's hard to generalize, but I will provide some rules of thumb. If the application is industrial I would check ASIC ROI (Return on Investment) starting 20K/Year, in commercial around 200K/Year. There are some additional conditions - unlike the FPGA ASIC is not field programmable, therefore customer should be able to freeze the design. Time to market is 1-1.5 years to mass production and initial NRE budget is required.

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- Replace End of Life with a Pin Compatible solution".

The synergy with Avnet Silica

Yulia: "ASIC is a high volume oriented product, in some cases customer that designed with Avnet based on FGPA or ASSP, will encounter price issue while ramping to high volume, or will need to optimized power or area that can't be reached using FPGA. In this case, simple Return on Investment calculation can show that ASIC NRE investment will be returned in few years, and the saving in the long term will be huge. This enables Avnet to enhance its line card with custom devices and that allow maximum optimization and IP protection. A second scenario is System in Package (SiP) – miniaturization of existing customer board into a single package with several dies. Due to the ASIC mass production capabilities, we have a very strong packaging and test team and collaboration with Avnet enables access to bare dies of many vendors. This offering is unique, because any other SiP vendor has to find each die separately. SiP solutions usually very attractive for area saving and power improvement, their NRE is relatively low and time to market is fast. A third scenario is pin compatible replacement for end of life situations, when one of the vendors announces obsolescence for of his devices. In such case the longevity of the system is extended and secured, without going into risky and long redevelopment of the hardware and software."

Value to customer

While the traditional ASIC vendors are locked to specific manufacturer and technology. Avnet ASIC Israel has a different philosophy - we do not bound ourselves by technology or specific vendor. We are fabless and our focus is to maintain very strong network of Tier One Partners: IP and manufacturing, we are an authorized design center for most of them. Such approach enables us to build a unique solution, optimizing the specific targets of the customer. Our technical pre-sale team is experienced in understanding the unique needs of the markets we focus on, analyzing the tradeoff between technical solutions and cost, finding the right recipes for each customer – Silicon technology, IPs, Packaging. Whether it is low power for wearables, cost reduction for Consumer market or reliability for Automotive.

SMART MOBILITY - PRIVACY AND SECURITY

› Jan Tobias Mühlberg, Imec

Making car electronics safe again - a new security architecture for networked embedded devices

Modern vehicles are managed by a network of control processors that interpret sensor readings and operate actuators. These processors control much of the car's behavior and safety functionality, intervening when necessary e.g. for braking, steering, switching on the lights, popping up the airbags, optimizing the powertrain output, and much more. But only fairly recently these networks have also been hooked up to the outside world. This renders them vulnerable to attacks by hackers, a vulnerability for which today there is no effective mitigation available. Jan Tobias Mühlberg, research manager at imec - DistriNet - KU Leuven, explains how researchers at imec have risen to the challenge. The result is a new security architecture for networked embedded devices, carefully designed to fit in today's environments, a solution ready to be used to secure not only smart vehicles, but also other critical infrastructure, e.g. medical equipment, smart buildings, or power grids.

Islands of smart electronics

"Today's complex industrial equipment is monitored and steered by net-works of electronics, with sensors, actuators and control processors that continuously exchange messages," says Mühlberg. "In cars, e.g. this interaction is organized around the so-called CAN bus (Controller Area Network), designed as a closed, wired network; an island with no obvious access points for intruders." The specification of the CAN bus, and thus of networked sensing and computing in vehicles, is about 30 years old. Before, cars were mostly mechanical. The CAN offers a way for the growing number of heterogeneous sensors and control processors in a vehicle to send and receive reliable and timely messages without any sort of central computer. It connects e.g. the rotation sensors in the wheels with the anti-lock braking system

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(ABS) and with the drivetrain. For the purposes that it was designed for, as a standalone network, CAN works just great.

Jan Tobias Mühlberg: "You'll find comparable networks in industrial control systems and robotic assembly lines. They were all carefully designed and tested to take into account all kinds of exceptional states and errors, which made them quite safe … until recently."

Opening up to the world

Modern high-end cars have infotainment and navigation systems that are hooked up both to the CAN network and to the "outside world". Via these external networks, infotainment components communicate with the driver's mobile phone or headset, and receive software updates from their vendors. And with information from the CAN network, it is e.g. possible to turn up the volume of the music when you start to drive faster, or when you enter rough terrain. Autonomous vehicles will take this a step further and communicate with each other and with the traffic infrastructure to steer the car.

"So suddenly a car's CAN network does have potential entry points for intruders. All this communication with the outside is done over Bluetooth or IP networks, some of which may even connect to the Internet. And the Internet, if anything, is a highly untrusted network", says Mühlberg. "The CAN bus and its hard- and software components were not designed to operate in such an unsafe environment. CAN, for example, has no real form of authentication or authorization. If a syntactically correct CAN message arrives at the car's brake system, the brakes just assume that the message is legitimate and comes from a trusted source, not from somewhere else."

Moreover, the processors are designed to be very small, good enough for their task, inexpensive and consuming as little power as possible. They may run tiny operating systems and a communication and control application. But in contrast to, e.g., laptop or smartphone processors, they don't have memory protection or an isolated sandbox to run processes in. Every application running on a processor, also an application that shouldn't be there, is able to access and rewrite the complete processor memory."

Where is the risk in all this? Mühlberg: "Recently, researchers have demonstrated that they can remotely control a car by hacking its Wifi or Bluetooth gateway. In a high-stakes case in Ukraine, it was demonstrated that electricity grids may be taken over. And researchers at imec - COSIC - KU Leuven even demonstrated that they could hack pacemakers, eavesdropping on the devices and even injecting potentially fatal commands."

This is not to say that such attacks are easy: They require a high level of sophistication, ingenuity and patience. But because of the sheer number of, e.g., electronically identical cars, an attacker that manages to find a way into one system, poses a real threat to the security of very many such systems."

Creating isolated, safe harbors for processing

Today, there is no commercial mitigation available. In contrast to higher-end processors in e.g. laptops and smartphones, controller chips are small and resource-constrained. They lack the security features that have become standard on other processors, such as privilege levels and memory segmentation. And replacing all embedded processors with high-end systems is not an option, mainly because of high cost, complexity and higher power consumption.

"Therefore, we set ourselves the task of designing a secure architecture from the ground up", continues Jan Tobias Mühlberg. "An architecture that is suitable to secure today's embedded systems, such as CAN networks in cars, industrial control systems in manufacturing, or very small IoT devices. Such a system has to be low on complexity and cost, which is a definite requirement from the industry."

The researchers took a lightweight microcontroller as basis, and extended its design, adding secure memory management and a crypto unit that is optimized for low-power consumption. The result is a processor that is not much larger and doesn't consume much more energy (about 6 percent). But it can isolate the critical software, creating a kind of safe harbor for it to run in. Because of this isolation, the software cannot be compromised. Its trusted computing base is restricted to the hardware on which it runs. Barring vulnerabilities in a protected application itself, no software, be it applications or operating system components, running on the same processor or outside processes, can override security checks and read or overwrite the protected runtime state.

Knowing whom to trust

"But even if the processor that controls the brakes of your car can no longer be hacked, it will still obey a brake command that comes from an illegitimate source", admits Mühlberg. "Therefore, we limited the trusted sources of messages to those that can authenticate as legitimate. Thus a brake command should only come from a trusted processor, which itself cannot be hacked, and from an authenticated software component. That way, a car's CAN network is made up of small unbreakable applications that mutually authenticate and trust each other."

And as an embedded system will still be contacted from the outside, e.g. from a software provider that needs to install updates, or from the traffic infrastructure, imec's specialists have also implemented secure communication and remote attestation. Thus an outside party can send or receive messages to and from a specific software module on a specific node while being sure that it is the correct module (authenticity), that it has not been changed (integrity), and that its status is correct (freshness).

Demo at ITF Belgium and future work

Sancus, as the solution is called, is a security architecture for resource-constrained, extensible networked embedded systems, that can provide remote attestation and strong integrity and authenticity guarantees with a minimal trusted computing base. It consist of the extended microprocessor, the dedicated software to run in the safe harbors and a C compiler that generates Sancus-secured code.

Sancus is an ongoing project, and the researchers from imec's DistriNet - KU Leuven and COSIC - KU Leuven groups have a number of outstanding issues that they'd like to tackle.

One is ensuring the availability and real-time functioning of the network. "With our innovation, we can guarantee that any messages that arrive in a module are legitimate," says Mühlberg. "But we cannot yet guarantee that they will arrive. It would still be possible for an attacker to drop messages, which our solution can detect. In most cases this would probably not lead to dangerous situations, as the receiving node would raise an error and halt the system in a safe way. But it is of course inconvenient."

A second issue has to do with the safe operation of the secure software modules. Without formal design methodology and inherently safe pro-gramming languages, these modules are poised to have vulnerabilities that may lead to unsafe circumstances. But because we have managed to isolate small modules of trusted code, it should now also be possible to design these in a more formal, fault-free way.

Mühlberg's team is looking for collaboration opportunities with partners to develop suitable hardware/software solutions that are adapted to their needs: "At the Imec Technology Forum in Antwerp (ITF Belgium, May 16-17), we'll demonstrate Sancus, either in an automotive scenario or as a smart metering solution, another use case where embedded processors need security. It's also an excellent opportunity for any interested companies to come and talk with us. We can discuss in technical detail how we've managed to add tight security to these embedded networks, an issue that will become all the more pressing as smart autonomous cars start to communicate with their surroundings."

Availability and acknowledgements

To ensure that the Sancus results can be verified and reproduced, the hardware design and software of our prototype have been made publicly available. The hardware designs, all source files, as well as binary packages and documentation can be found here.

Sancus has been implemented by imec - DistriNet - KU Leuven and imec - COSIC - KU Leuven, two research groups famed for their work on security. The development has been supported in part by the Intel Lab's University Research Office. It was also partially funded by the Research Fund KU Leuven, by the EU FP7 project NESSoS, and by the Belgian Cybercrime Centre of Excellence (B-CCENTRE).

Biography

Jan Tobias Mühlberg is a research manager at Imec - DistriNet - KU Leu-ven. Before joining this research group, he did research at the University of Bamberg (Germany, until 2011), obtained his Ph.D. from the University of York (UK, 2010) and worked as a researcher at the University of Applied Sciences in Brandenburg (Germany, until 2005), where he obtained his M.Sc. Tobias is active in the fields of software security, and formal verification and validation of software systems, specifically for embedded systems and low-level operating system components. Tobias is particularly interested in security architectures for safety-critical embedded systems and for the Internet of Things.

He Who Goes First...Loses

› Paul McLellan, Cadence

There is a saying, of course, that he who goes first wins. And sometimes, and in some ways, that is true. But not always, and especially not always in the long run.

Forlorn Hope

The most obvious example of going first being dangerous is the forlorn hope in a military context. They were the first people through a breach in the castle wall or whatever. Casualties were likely to be very high. To make this attractive, the rewards for survival were riches and promotions (and glory).

London Underground

Here's a different type of example. The London Underground (the "tube" - or subway, in American terms) was opened in 1863. Initially, the tunnels were near the surface and were built by "cut and cover" - a big ditch is dug out, the tunnel is created, and then the surface is replaced. But later, the deeper lines were built with circular tunnels. These lines had to be built with Victorian tunneling technology. As a result, the tunnels are too narrow, and they are very windy since Victorian tunneling technology was not up to going through hard rock, so it had to go around. So that is what London is stuck with. You can't exactly widen a tunnel while keeping service running for about 20 hours per day. This is the same problem New York has with the Holland rail tunnel, which was one of the motivations for wanting to build a second tunnel. The problem for London with the small bore is that the trains are very crowded. They are very hot in summer - there is no air conditioning and the tunnels are too small to add it. Some of the stations are very curved, leading to the famous "mind the gap" announcements (and by the way, it is an urban legend that the guy who voiced that message gets a royalty each time it is said).

So the bottom line is that London had an underground railway when nobody else did, but it is stuck with 150-year old decisions that can't be changed. You know why Beijing's subway is better? Because they only really built it for the 2008 Olympics, so they could use modern technology and techniques.

subway station in Beijing

Mobile Payment

M-Pesa

Do you know what M-Pesa is? Pesa is the Swahili for "money" (this blog is nothing if not educational) and the "M" stands for mobile. It is a money transfer system in Kenya and Tanzania for moving money around using cheap (not smart) phones. It is ahead of anything else until, maybe, smartphones came along. Almost nobody in those countries has a bank account, and so everything operated in cash. Of course, if your son were in the city and wanted to get money to you, either he or a trusted friend had to hop on a bus and give it to you in person. Of course, lots of robberies took place. M-Pesa now carries nearly half the country's GDP. When I was in Tanzania doing Kilimanjaro a couple of years ago, there were shacks at the side of the road with M-Pesa signs that were effectively mini-banks.

Mobile payments have been slow to take off in the US because we already have a good credit card system. It even took a decade after most of the world to put a chip in the credit cards since there were pretty good fraud detection systems by then. Now Apple Pay works really well, taking only a split second, whereas those credit cards with chips seem to take forever to do a transaction, confusingly saying "thank you" and then going back to telling you not to remove your card.

Airports and Bridges

The US is famous for bad airports, especially as compared to Asia. Changi in Singapore is regularly rated best airport in the world. To be honest, I think we do OK here, and SFO is fine, and with the best food of any airport anywhere. Famously, Paris's main airport CDG has really bad food, especially for a country that prides itself on its food. (And here's another bit of education for you: if you are in Paris, it is considered hick behavior to call it "Charles de Gaulle" airport - it is always Roissy, the village beside where the airport was built.) But again, part of the problem is those bad airports (like JFK) were built really early and it is hard to rebuild an airport and keep it running. The best solution would be to build a new one and cutover like Munich or Denver did.

However, there does seem to be another problem with public infrastructure projects in the US, which is that they are not regarded as a way to get infrastructure built, but as a way to deliver patronage and employ people. If we were serious about building the Second Avenue subway line in Manhattan, we'd just get a Chinese company to do it for 25 cents on the dollar or less. Instead, we have a fiasco. The line was planned in 1919 and construction started in 1972. The first small phase opened finally at the start of this year. The "big dig" in Boston, the new Bay Bridge, every light rail line ever, all run multiple times over budget in both dollars and time because we are not serious about getting them built, we are more concerned to use American steel, and union labor and so on, and lots of it.

If you lived in the Bay Area about ten years ago, you might remember when a tanker truck caught fire under a section of 580 and took down a bridge. For once, people

Changi International Airport, Singapore

focused on getting it open, and within 24 hours - without even a contract in place (thus breaking all the rules for contracting public works) - a demolition company was getting rid of the old bridge. The new one opened about 30 days later. So it is possible if what is important is delivering to the public, rather than patronage.

And it wasn't always this way. Although the new span of the Bay Bridge only opened in 2014-25 years after the 1989 earthquake that showed up the problems - the original Bay Bridge was built in 3 years. We just don't seem to be able to do that anymore.

New EDA Point Tools

Things have changed a bit in the last few years in EDA, which I'll get to later, but it used to be extremely difficult to introduce a new product into the channel because the salespeople knew that going first was a recipe for problems. The product was immature, and the salesperson and associated AE team would have to spend time addressing them. Everyone sat on their hands, waiting for others to go first so that when the product was mature, they could rush in. Nobody wanted to be the forlorn hope; the rewards were not big enough.

This was brought home to me after Cadence acquired Ambit in the late 1990s (I was VP Engineering). We had a synthesis product (amusingly named BuildGates), and Cadence had recently canceled their own internal development on Synergy. It was important that the product be sold aggressively to justify the high purchase price (nearly $300M if I remember right). But the salesforce would not. The Cadence salesforce was accustomed to closing deals on the basis of trying to get the entire budget except for synthesis. Very few customers (Philips was the only one) were going to make a wholesale switch, but they would probably take a few copies, and then maybe lots later. No salesperson wanted to risk messing up a multi-million dollar deal for a few hundred thousand dollars on a product they knew little about. While there were some sales, the sales goals were missed by a lot.

Another Cadence example was back in the same era. We had developed a lot of formal verification technology at the Cadence Berkeley Labs. This was then transferred to Cadence proper and productized under then name "Heck". This was not a good way to work anyway - you can only really move technology in people's heads - but that's a topic for another day. I have no idea if the technology was any good; in that era, formal verification was a niche market and very hard to use. But again, we never found out, since the sales team refused to sell it, and after about a year it was quietly dropped.

Hunters and Farmers

This is one reason that back in that era when you could sell a point tool without needing it to be completely integrated across the entire flow, startups could sell products. Their sales people were hunters, finding the early adopters to get the product across the chasm, as opposed to the sales forces of the big companies who were farmers, working the fields of the big customers.

So the strategy of the ecosystem was to develop new technology in startups. They would get the product moving in the channel, then the big companies would buy the successful companies. Then the farmers would move in. If the big companies developed internal

technology, the salesforce would not sell it and it would fail. You can't get a point tool started with the farmer approach.

There are only a couple of products I can think of back in that era that were developed by big EDA companies (once they were out of their own startup phase) that became successful; these were Calibre and PrimeTime (and even that second one is dubious since the #1 product in the space, Motive, was acquired and shut down, leaving a vacuum to move into).

Today

I think the situation today is actually a bit different. Each new process generation brings new challenges (FinFET, double patterning etc) and so any leading edge customer has no option but to adopt the new version. Everyone - Cadence and the customer - knows there will be issues. Everyone knows we will all have to work together to solve them. There are still one or two startups in little niches, but they are the exception and far less numerous than twenty years ago when DAC would not just fill part of the south hall at Moscone, but all of it. And the North Hall, And use the corridors in between as overflow space for still more companies.

Solving problems together has always been the case to some extent. When I was one of Cadence's co-CTOs, I used to end up in arguments with the VP Engineering of one of our big customers. He would complain that our software was buggy for leading edge nodes. I would tell him to use an old version, but we both knew that was impossible; the capabilities were not available in the old version. Then we would have some test cases in the new node before we released the software, and we'd test it better. But this was also a non-starter since the test cases can't be produced until the software is - if not up and running - at least up and staggering. So actually the situation was the same back then, but less well acknowledged.

The startup approach no longer works. This is partially due to the investment climate, but also because the problems to be solved (such as coloring vias) require you to have a full flow already. There is no niche for the "via coloring company," no matter how compelling the technology. It has to work in layout, place and route, physical verification and so on, so you have to have it all already.

Driving a single-phase BLDC motor

› Mike Gomez & Mark Pallones, Microchip Technology

How to use a low-cost microcontroller as a driver for a single-winding, single-phase brushless DC motor

In a low-power motor application, where cost is more important than complexity and torque requirements are reduced, a single-phase brushless DC (BLDC) motor is a good alternative to a three-phase motor.

This type of motor is low cost because of its simple construction, which is easier to fabricate. Also, it only requires a single-position sensor and a few driver switches to control and energise the motor winding. Therefore, the trade-off between motor and control electronics can work out favourably.

To maintain the cost effectiveness, a low-cost motor driver is needed. The driver circuit described here can exploit two feedback loops. The first, the inner loop, is responsible for commutation control, while the second, the outer loop, handles speed control. The speed of the motor is referenced to an external analogue voltage and fault detection can be sensed during over-current and over-temperature conditions.

Fig. 1 shows the single-phase driver based on Microchip's PIC16F1613 8bit microcontroller, chosen because of its low pin count and on-chip peripherals that can control the driver switches, measure the motor speed, predict the rotor position and implement fault detection. This application uses the following peripherals: complementary waveform generator (CWG); signal measurement timer (SMT); analogue-to-digital converter (ADC); digital-to-analogue converter (DAC); capture compare PWM (CCP); fixed voltage reference (FVR): timer; comparator; and temperature indicator. These peripherals are internally connected by firmware, which reduces the number of external pins required.

The full-bridge circuit, which energises the motor winding, is controlled by the CWG output. A Hall sensor is used to determine the rotor position. Current that passes through the motor winding is translated into a voltage through

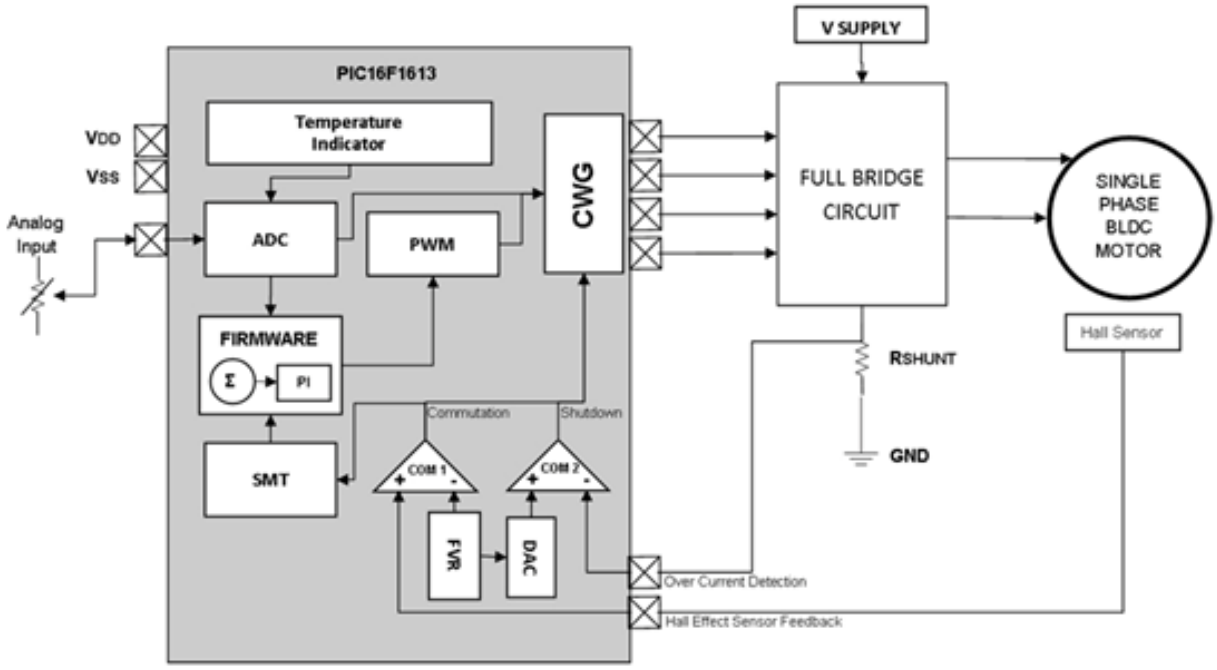


Fig. 1: Block diagram of single-phase BLDC driver

the sense resistor Rshunt for over-current protection. The speed can be referenced in an external analogue input. Fig. 2 shows the control diagram of the motor driver; for this application, the rated motor voltage is 5V and rated speed 2400rev/min. The motor driver supply voltage is 9V.

The speed reference can be any analogue input. The microcontroller's ADC module has 10bit resolution and up to eight channels, making its suitable for different kinds of analogue input. This is being used to derive the speed reference and the initial PWM duty cycle, used to initialise the speed of the motor based on the source of the speed reference.

The initial duty cycle can be increased or reduced by the result of the proportional-integral (PI) controller and the new duty cycle value loaded in the CCP, the PWM output of which is used as the initial source of the CWG to control the modulation of the lower side switches of the full-bridge driver and, hence, the speed of the motor.

Inner loop

The inner feedback loop is responsible for commutation control. The CWG output, which controls the excitation of the stator winding, depends on the state of the Hall sensor output, which is compared with an FVR by the comparator. The comparator hysteresis is enabled to disregard the noise in the sensor output.

The output of the comparator toggles between forward and reverse full bridge mode to produce clockwise or anti-clockwise rotation. The CWG output is fed to the switches' input of the full bridge circuit.

To produce one electrical cycle, a forward-reverse combination must be executed. One mechanical revolution of the motor requires two electrical cycles, therefore two forward-reverse combinations must be executed to complete a single clockwise rotation of the motor.

Full-bridge circuit

The full-bridge circuit in Fig. 3 is primarily composed of two p-channel MOSFETs as high-side switches and two n-channel MOSFETs as low-side switches. The main advantage of the p-channel transistor is the simplicity of the gate-driving technique in the high-side switch position, thus reducing the cost of the high-side gate-driving circuit.

Even though the high- and low-side switches can be switched on at the same time - cross conduction - this kind of switching should be avoided otherwise it will create a current shoot-through that might damage

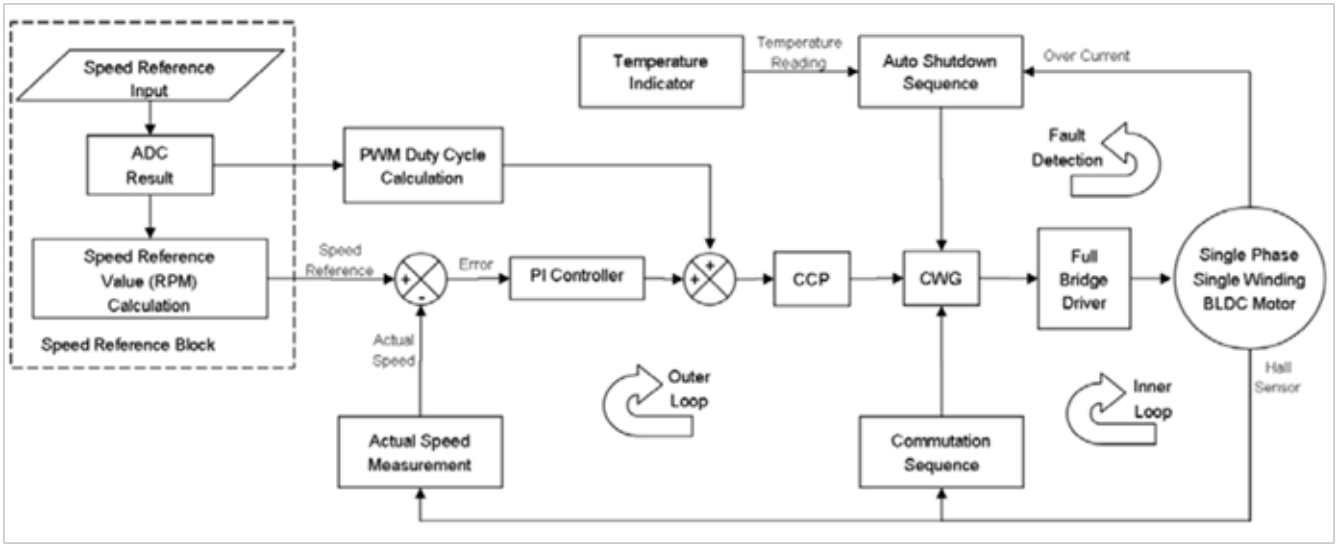


Fig. 2: Control diagram of motor driver

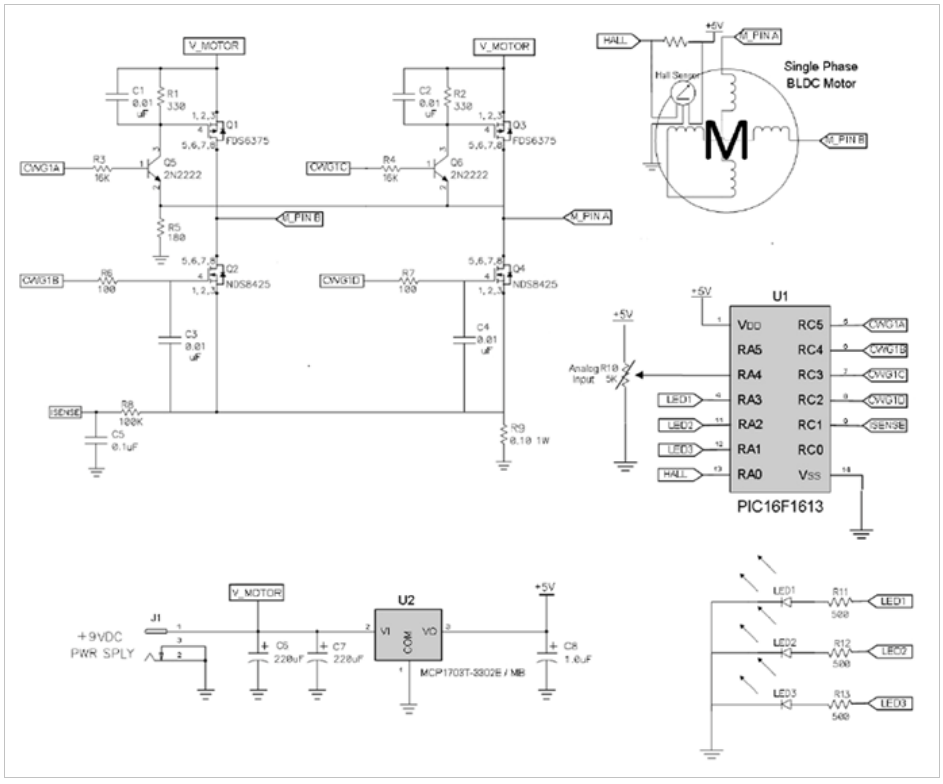


Fig. 3: Single-phase BLDC motor driver schematic diagram

the driver's components. To avoid this, a dead-band delay can be implemented using the CWG's counter registers. This provides non-overlapping output signals that stop the high- and low-side conducting at the same time.

Ideally, the n- and p-channel MOSFETs should have the same on resistance (RDSon) and total gate charge QG to obtain the optimal switching performance. Therefore, while it would be good to choose a complementary pair of MOSFETs to match these parameters, in reality this is impossible due to their different construction; the chip size of the p-channel device must be two to three times that of the n-channel to match the RDSon performance. But the larger the chip size, the larger the effect of QG. Thus, when selecting the MOSFETs, it is important to decide whether RDSon or QG will have the biggest impact on switching performance and choose accordingly.

Fault detection

Exceeding the motor's maximum allowable torque loading can cause

the motor to stall and the winding to take the full current. Thus, to protect the motor, fault detection for over current and stalling must be implemented.

To implement over-current detection, Rshunt is added to the drive circuitry, which gives a voltage corresponding to the current flowing in the motor winding. The voltage drop across the resistor varies linearly with respect to the motor current. This voltage is fed to the inverting input of the comparator and compared with a reference voltage based on the product of Rshunt resistance and the maximum allowable stall current of the motor.

The reference voltage can be provided by the FVR and can be narrowed down further by the DAC. This allows a very small reference voltage to be used, which lets the resistance be kept low thus reducing power dissipation from Rshunt. If the Rshunt voltage exceeds the reference, the comparator output triggers the auto-shutdown feature of the CWG, the output of which will remain inactive as long as the fault exists.

Over temperature can be detected using the device's on-chip temperature indicator, which can measure temperatures between -40 and +85°C. The indicator's internal circuit produces a variable voltage relative to temperature and this voltage is converted to digital by the ADC. For a more accurate temperature indicator, a single-point calibration can be implemented.

Outer loop

The outer loop shown in Fig. 2 controls the motor's speed under varying conditions such as changes in load demand, disturbances and temperature drift. The speed is measured by the SMT, which is a 24bit counter-timer with clock and gating logic that can be configured for measuring various digital signal parameters such as pulse width, frequency, duty cycle and the time difference between edges on two input signals.

Measuring the motor's output frequency can be done through the SMT's period and duty cycle acquisition mode. In this mode, either the duty cycle or period of the SMT signal can be acquired relative to the SMT clock. The SMT counts the number of SMT clocks present in a single period of motor rotation and stores the result in the captured period register. Using this register allows the actual frequency of the motor to be obtained.

When the speed reference is compared with the actual speed, it will yield a positive or negative error depending on whether the actual speed is higher or lower than the set reference. This error is fed to the PI controller, which is a firmware algorithm that calculates a value that compensates for the variation in speed. This compensating value will add to or subtract from the initial PWM duty cycle to produce a new value.

Conclusion

In cost-sensitive motor control applications, an efficient and flexible microcontroller can have significant impact. Device efficiency can be measured against the level of integrated peripherals to optimise the control task along with the number of pins and memory and the size of the package. Additionally, ease of use and time to market are important especially if variants of the design are required. This article has shown how a low-cost microcontroller can meet these requirements and let the driver set the desired speed reference, predict the rotor position, implement a control algorithm, measure the actual speed of the motor and impose fault detection.

Industry 4.0 Let's look at the big picture

› Molly Connell, TradeMachines

The 4th Industrial Revolution is a highly discussed topic and it gained even more attention when it became the focus of discussions at the World Economic Forum's Annual Meeting in 2016. Industry 4.0 has brought and continues to bring fundamental changes to manufacturing, which some welcome, some fear.

Those who welcome it see the potential in the technical advancements which Industry 4.0 holds. The factories which have been improved with the latest technology are called smart factories. The components of these factories are connected and together they create a web of information and production, the so-called Industrial Internet of Things. A perfect example is the Siemens (IW 1000/34) Electronic Works facility in Amberg, Germany. The 108,000-square-foot high-tech facility is adequate for a built-to-order process involving more than 1.6 billion components.

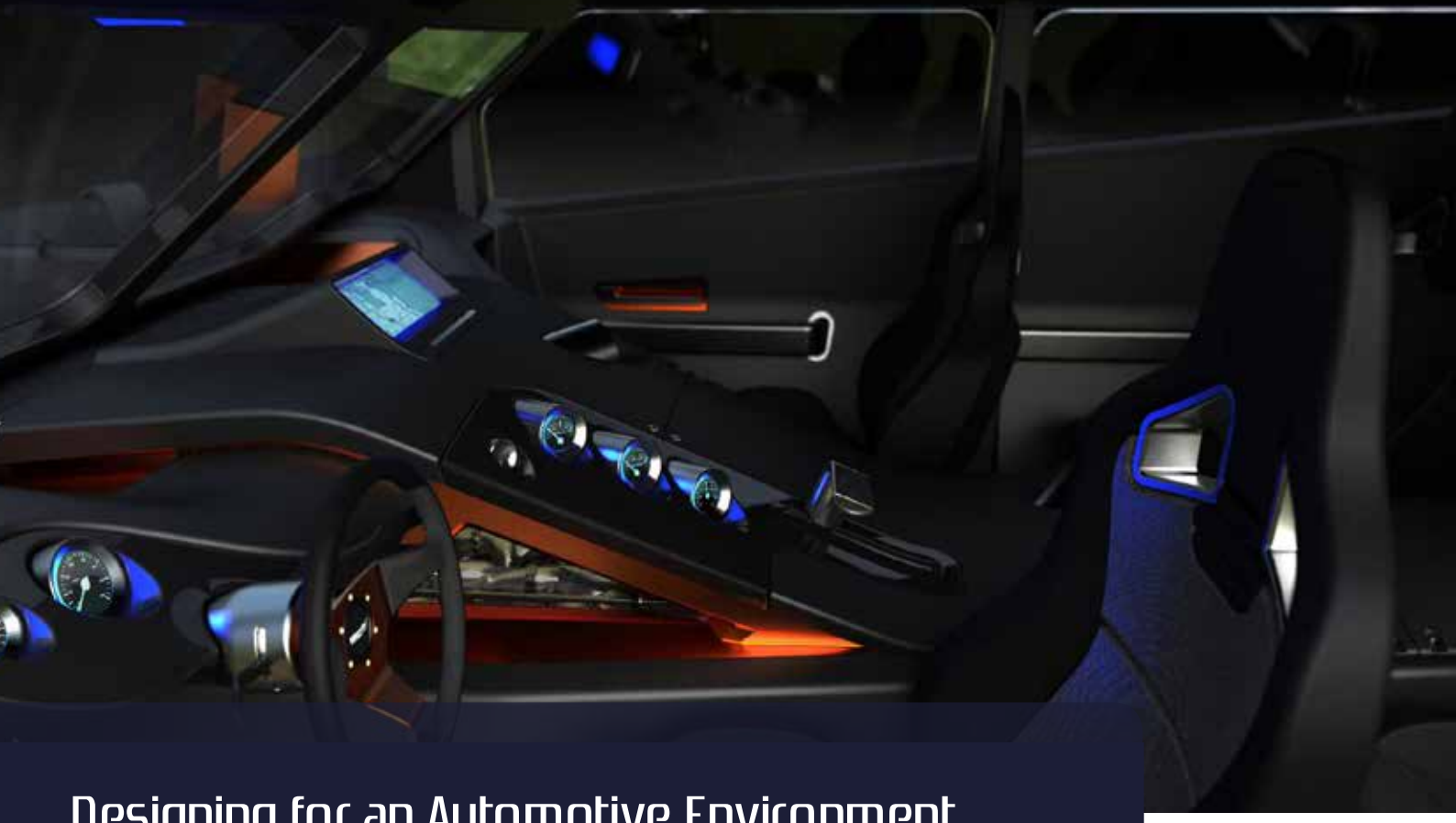
An advanced factory like this improves manufacturing processes in numerous ways compared to traditional factories. In a summary from RobotWorx, decreased production costs by shorter cycle times (among others) and improved quality and reliability are named first. They also emphasize the advantage of better floor space utilization which is possible by decreasing a footprint of a work area. By reducing the factor of human mistakes one can calculate with reduced waste as well. It is also important to highlight the increase of safety since human workers are moved to supervisory roles where they no longer have to perform dangerous applications in hazardous settings. And last but not lease adaptability is also a key factor for success and robots and AI are suitable for performing a variety of applications.

It is also very important to emphasize that having a smart factory has became affordable: there are agile factory robots for as little as $25,000 already, which is financially equivalent to paying a full-time human worker $4 an hour over the life of the machine.

As a proof of the previously mentioned advantages, the Siemens Work facility only records about 15 defects per million and has shown a 99% reliability rate and 100%

Industrial Robots

traceability on its expansive lines. The numbers speak for themselves.
Having new opportunities at hand, thanks to the 4th Industrial Revolution, companies seem to re-shape their strategies. Hybrid business models are becoming more and more popular. This new constellation allows participating product providers and service providers to share core competencies to develop products and services together or companies with the means to expend their market reach. "Smart products" do not only have physical characteristics, but are also provided with sensors which allow traditional manufacturers to integrate their products with high-quality services, to enhanced customer and supply partner experience. A prefect example is Michelin, which introduced it's new sensor-equipped tires. With the data received on fuel consumption, tire pressure, temperature, speed and location and the necessary analytics, they are now able to coach truck fleet drivers on how to save fuel.
Another hybrid model success story is Daimler, with its Car2Go service. With equipping their Smart cars with the necessary information technology, they have taken their business beyond simply building cars to renting them. Both these companies entered a new market by improving their original products by utilizing what technology made possible.
Since for some businesses, as proven previously, automation is unquestionably an improvement with financial benefits, the demand for industrial robots is getting bigger. According to the International Federation of Robotics, while in 2000 there were 750.000 robots in operation, this number increased to approximately 1.8 million by 2016. They are expecting a further, more rapid growth in stock of industrial robots having 2.6 million robots in operation by 2019. The fact, that in 3 years the increase is supposed to be almost 50%, makes some experts quite concerned and recognize robotic automation as an "inevitably disruptive force". The World Economic Forum predicted that robotic automation will result in the net loss of more than 5m jobs across 15 developed nations by 2020.
On the other hand though, according to one of the articles in the Harvard Business Review, if human workers could fully be replaced by robots than greater employment drops would be experienced in countries with higher investment rates in automation, but so far there is no proven relationship between a countries use of robots and the percentage of manufacturing job lost.
With the title "Robots Will Take Our Jobs - But We Will Adapt" the TIME published an article in which they explain how this extremely fast and dynamic change caused by robots and Artificial intelligence can be beneficial to everyone. Tyler Cowen and other experts have suggested, that "humans must develop skills that complement the functions that computers and AI systems perform well."
We should think of Industry 4.0 as a change in life we can't ignore. It will mean a shift in the labor market, a new way of manufacturing, it opens up a completely new era. One can take advantage of it by being proactive and having an open mind, it's time to be pioneers.



Designing for an Automotive Environment

› Eyal Cremer, Yama RD

Driving on the Highway. The phone rings. It's Italy's area code, +39.
Mateo is phoning to tell me they've decided to move the Alfa Romeo's studio to Israel, that they need engineers and designers and that he only wants to ask me if I know people who would like to apply for the job. The alarm clock goes off and the dream is gone.
True, an exotic automotive company has yet to open a design studio in Israel, but there is a revolution in the vehicle realm and it offers other options. The electric and autonomic era is on our doorstep, and if up till now Israel was watching the automotive industry from the sidelines, nowadays we have a real chance to get into the mix. Companies like Mobileye, Waze and Better Place have made the impression that they have something to look for in Israel, not only for its technology but also for its fearlessness and development philosophy, which are so foreign to the traditional automotive industry.
Nowadays one can see a lot of startup companies developing relevant products, from complementary products up to actual cars. So now it's time to ask if there is a unique way to design a product for the automotive realm.
Since the beginning of the 20th century, cars have become devices which external form derives from the way they function and the way they are used. This obviously does not mean there weren't nifty looking cars (Bugatti Type 35, for example, but also many others), but it does mean that design was not part of a separate developing discipline. Still, those cars are the cornerstones of vehicle design to this day.
Car design has become a separate discipline when people started making vehicles with Monocoque chassis or a partial chassis. Actually, the car casing depended less on its content. The shapes could be richer and unique for every model or manufacturer.
The first car designing studio was established by Harley Earl in General Motors in 1936, and it laid the foundation for the field. Since then, the car has been distinct in comparison to other products, and was an expensive and significant commodity. It has

THE ARROW QUADRO IoT Wi-Fi Kit

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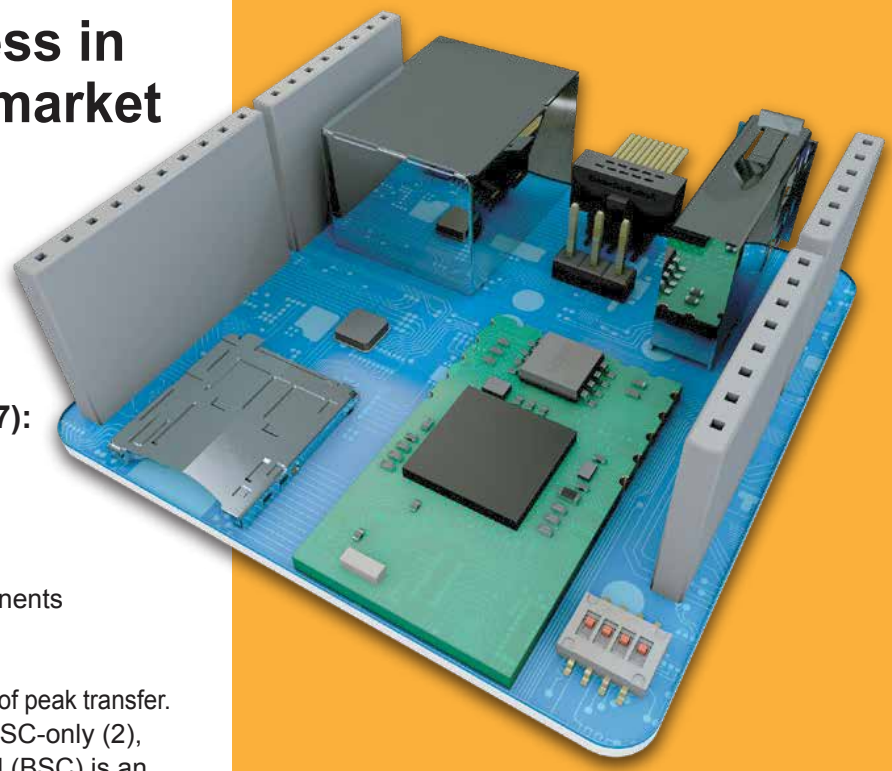

Features (Based on Cypress CY43907):

Application Processor Features

- ARM Cortex-R4 32-bit RISC processor.
- 1 MB of on-chip SRAM for code and data.
- An on-chip cryptography core
- 640 KB of ROM containing WICED SDK components such as RTOS and TCP/IP stack.
- 17 GPIOs supported.
- Q-SPI serial flash interface to support up to 40 Mbps of peak transfer.
- Support for UART (3), SPI or BSC master (2), BSC-only (2), and I2S (2) interfaces. (Broadcom Serial Control (BSC) is an I2C-compatible interface.)
- Dedicated fractional PLL for audio clock (MCLK) generation.
- USB 2.0 host and device modes.
- SDIO 3.0 host and device modes.

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Rally Car for Abramov R&Ddiagram

Above: a folding car for CityTransformer
On the right: Hardened tablet for truck fleets for Micronet
Headline photo: inside a 4X4 for Logic

unique requirements. The design serves a number of issues. The obvious issues like aesthetics or ergonomics also appear in other products. Although some of the design challenges are common with other consumer goods, they are especially significant in car design.

The first challenge is seasonality, a concept borrowed from the fashion industry. In 1942, Alfred Sloan, Head of Marketing and Sales in General Motors, suggested that every company in the Corporation should come up with a new model or design every year. The goal was to encourage the consumers to replace their cars more frequently (until then the models were not replaced for more than a decade). Many of the smaller manufacturers disappeared because of the new GM norm, unable to meet the frequent design changes.

The second challenge is the design language. Nowadays most of the consumer goods companies strive to create a precise design characterization and language, but in car design it's critical and of the utmost importance. The design language is managed zealously, and its goal is positioning the car from a marketing point of view, and stirring expectations about the car's "behavior" and even its "social status." For example, the BMW creates a feeling of a very long engine compartment (by pushing the front wheel to the edge and flattening the nose). It also integrates voluptuous lines that divide the car and create sharp and fast elements, like the headlights. The goal is to relate to the BMW's characterization as a strong and wild but also a manageable car. That's the company's "genetic code." Audi is another example of this category: it derives elements from the industrial world, sharp and distinct lines as well as an expressive waistline. As in the BMW, the goal is to project strength, but also precision and restrained power. That's Audi's genetic code.

The third challenge is the emotional characterization. With this characterization the companies attract their clients and bond with the drivers. Actually, the company attempts to create a faithful tribe. We've all heard of "the Alfa crowd" or people "who will only drive a Toyota." A lot of people use a car photo as their computer background picture. When did you last see a T-shirt with a Phillips print or someone with a toaster screen saver on their cell? The emotional characterization is part of the design, but it's focused on the feeling the manufacturer wants to evoke in the client (as opposed to the actual feeling). Cars can feel like sports cars and others less so, even if they are in the same category and have an identical or a close performance package (for example, the sportive Seat and its VW sibling, the domesticated Skoda). The emotional characterization is a whole package that can be seen in commercials, car races etc. In design, it can be expressed in the

nature of the dividing lines, in the wheels and body proportions, etc. For example, the strong horizontal and balanced lines in the Skoda versus the curved lines that create a gliding motion around the wheel in the Seat.

But above all that there's a special tone. Even the Skoda (which is fabulously designed, in my opinion), with its calm and mild design, is "dynamically designed." It has a strong and dominant shoulder line, a slender thickening above the wheel well and a unique and strong window line. How does the cliché goes? "Make it look like it's moving even while standing still."

While designing a product for the automotive environment, do we have to accept these rules and premises? Does the navigation screen we added to the car should look like it's "going 60 mph" even while standing still? Not necessarily. First of all we have to understand the placement of our product in the physical and the conscious space. Are we talking about the interior or the exterior? Is the product adapted to a specific brand or is it supposed to fit a wide range of companies? In my opinion, the rule of the thumb is that if the product is specifically made for a certain car, it should be loyal to the brand's rules, the genetic code and the values of car design.

Now I want to talk about the car interior as a test case. An interior product can be essential (like Awacs, Mobileye) or a by-product (a screen or a camera). It can also be a "stupid" product like a cup holder or a child safety seat. In recent years, the car interior has undergone big changes. The many functions and operation facilities make the car very crowded, especially the driver's surroundings. It creates a basic challenge to find enough space, but it's also a designing challenge. It's hard to fit a product for a crowded space. It's especially hard when you have to design a product that will cater to different manufacturers and models. This difficulty leads to a growing propensity to make products designed specifically for a certain model or manufacturer. It's a challenge and a logistical hurdle cost-wise, but it's crucial so the clients and distributers will agree to include these products in their cars. Nowadays, professional drivers (truck drivers or cabbies) expect a well-designed product. Obviously these products will be industrial and tougher looking, but there is still an expectation for a meticulous design. Today the industrial products for the car's interior are less "dynamic" or influenced by a specific manufacturer's design language. Even such products will have to assume more of the automotive design rules and maybe even find a way to adjust themselves to certain models in order to overcome the consumers' objections to "messing with their new truck's design." Even if our dream won't come true and Alfa Romeo won't open a studio in Israel, the growing involvement of the Israeli industry in the vehicle and transport field is an opportunity for design innovations. Local manufacturers and developers should embrace the principles and meticulousness that characterize the car industry as part of endeavoring to involve Israel in the transport revolution that's coming our way.

Eye measurements on HDMI signals with the R&S VT-B2380 TMDS time domain analyzer

› Rohde & Schwarz

Introduction

HDMI is a wired transmission standard for uncompressed video signals between consumer home electronics equipment.

Uncompressed video requires a high data rate. For example, an HDTV picture displays 1920 * 1080 = 2 073 600 pixels, with each pixel consisting of 3 color values (red, green and blue) with 8-bit quantization. For historical reasons, a synchronization frame with free data ranges (e.g. for audio) is added along with additional bits for transmission coding. An increase in the quantization ("deep color") is also possible, which naturally requires an increase in the data rate.

In total, HDMI transmission requires a data rate range of 3 * 250 Mbit/s up to 3 * 3.30 Gbit/s for all conventional aspect ratios and refresh rates. This range is specified by HDMI 1.4b.

For UHDTV (4k) with refresh rates of 50 Hz or 60 Hz, the data rate was extended in HDMI 2.0 to 3 * 5.94 Gbit/s. The factor 3 is used here because HDMI is equipped with 3 data lines.

Serial data transmission in accordance with the HDMI standard

Data on HDMI cables is transmitted serially on one wire pair using current mode logic. In other words, the transmitter contains a current sink that is switched so that it is out of phase with one or the other wire, depending on the logic information. The receiver terminates the wires with 50 ohm to +3.3 volt and uses a differential amplifier to access the logic information.

The spectrum of the HDMI data signal corresponds to that of digital NRZ signals and is made up primarily of signal components up to the bit rate and additional components up to 2 and 3 times the bit rate. For signal analysis at 5.94 Gbit/s, this translates into a required measurement bandwidth of up to 18 GHz.

These high bandwidth requirements apply not only to the test instrument, but also to the plug connector and the cabling to the test instrument.

Compliance tests

To ensure connectivity of devices from a wide variety of manufacturers, the HDMI Forum has prepared the Compliance Test Specification (CTS). This specification assists in

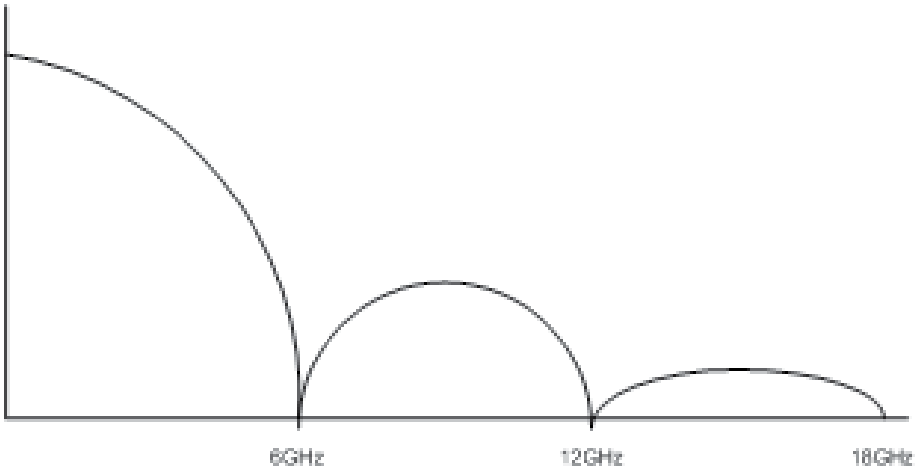

Fig. 1: Spectrum for a 6G TMDS in line with HDMI 2.0

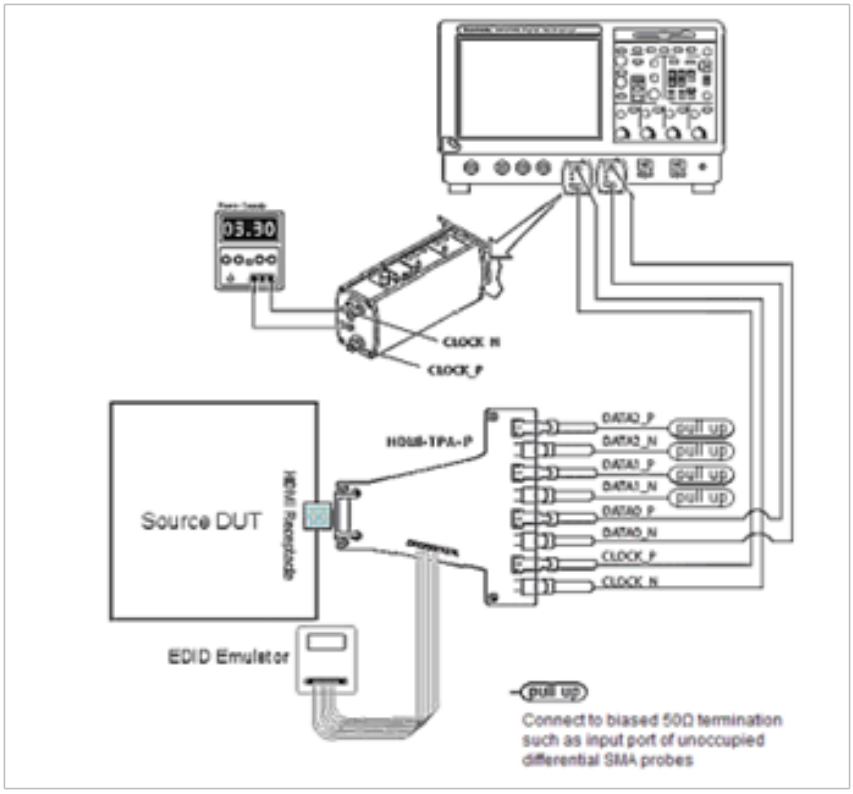

Fig. 2: Example test setup for measuring the TMDS eye diagram (source: HDMI 1.4 specification)

assessing the characteristics of HDMI components or consumer electronics equipment. Manufacturers are authorized to use the HDMI logo for devices that pass these tests. A portion of the tests is based on the electrical characteristics of HDMI signal sources.

This document specifically addresses these electrical tests for HDMI sources, which alone represent an enormous investment in test equipment.

Typical test equipment required for measuring the signal quality of an HDMI source includes a real-time oscilloscope (RT scope) connected to the HDMI source under test via an HDMI test point access adapter (Fig. 2).

However, the serial data transmission characteristics for HDMI described above are extremely demanding on the RT scope. A sampling rate of 40 Gsample/s and an analog bandwidth of > 12.5 GHz for HDMI 2.0 signals or a minimum of 20 Gsample/s and 8 GHz bandwidth for HDMI 1.4b are the basic requirements.

Some of the tests are defined as time difference and voltage measurements at specific trigger points, while other measurement values are calculated from statistical information (eye diagram). The test specification precisely describes how to perform the tests using RT scopes. A less time-consuming and less costly alternative is eye diagram measurement using subsampling. Signal parameters such as amplitude and time are determined exclusively from the measured eye diagram, without the option of triggering on specific bit sequences. The measurement principle is explained below.

Principle behind the data eye diagram measurement

Subsampling The intent of the data eye diagram measurement is to ensure that an HDMI sink receives data from an HDMI source without errors. This is done by means of

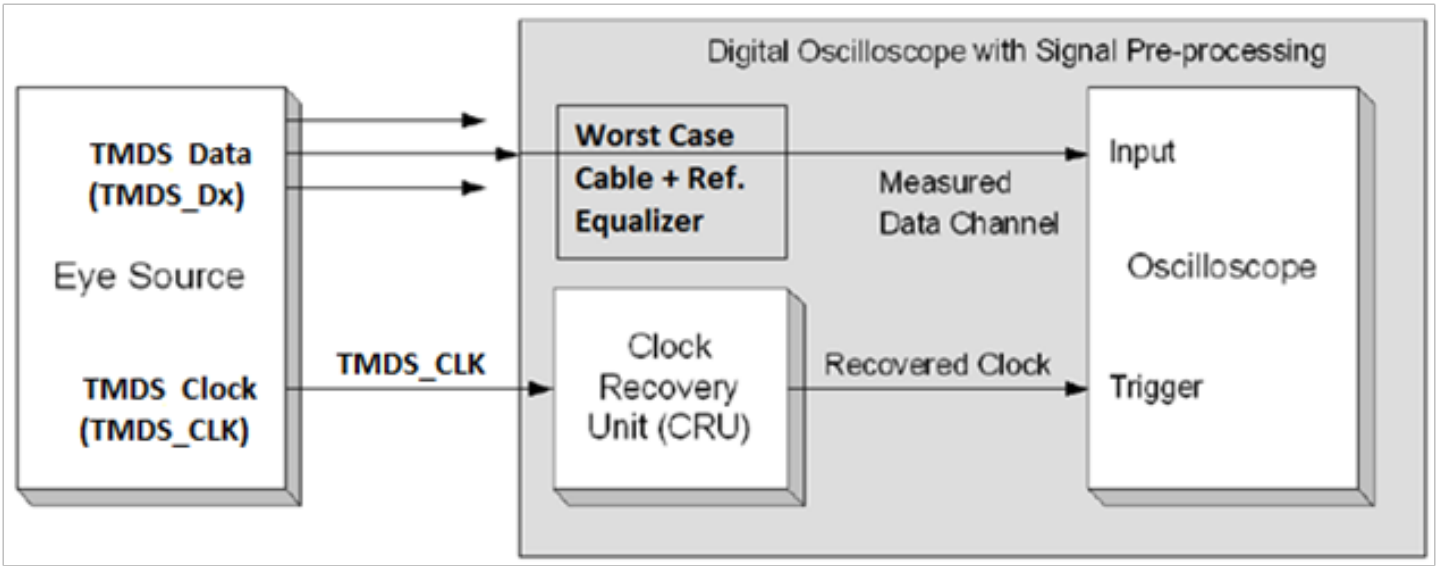

Fig. 3: Specification for measurement of the TMDS eye diagram (source: HDMI 1.4 specification)

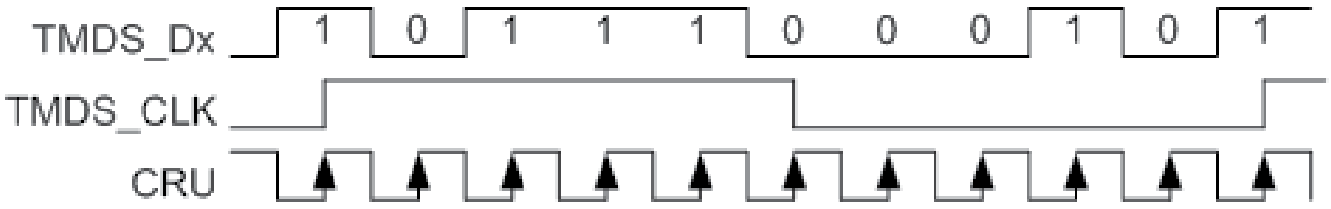

Fig. 4: The clock recovery unit

an eye diagram measurement. The eye diagram can be used to assess the signal quality and to determine possible transmission errors. The HDMI CTS defines how the measurement has to be carried out, which is shown in Fig. 3.

To display the eye diagram, the clock recovery unit (CRU) is used to recover the data clock from the TMDS clock (see Fig. 4). The recovered clock is used to trigger the oscilloscope, which lays all waveforms over each other. The CRU follows the TMDS clock to a certain extent. The CRU transfer function is specified in detail in the HDMI standard.

The HDMI standard assumes that the measurement is performed using a real-time oscilloscope (RT scope). With a RT scope, the CRU as well as the formation of the eye diagram are realized in software. Measurements of HDMI 2 signals require an analog bandwidth of >12.5 GHz. This equates to sampling rates of ~40 Gsample/s, making these instruments very large and expensive.

The Rohde & Schwarz VT-B2380 TMDS time domain analyzer solution, on the other hand, presents an alternative approach to the RT scope: subsampling. Subsampling makes use of the fact that the data is recurring and the statistical characteristics remaining fairly constant over the duration of the measurement. Advantages of subsampling include decreased hardware complexity while retaining a high analog bandwidth of >12.5 GHz, good integrability, low thermal losses and a significant cost advantage.

The principle behind subsampling is shown in Fig. 5. The applied analog signal TMDS_Dx is to undergo subsampling. The clock designated as CRU_x corresponds to the clock

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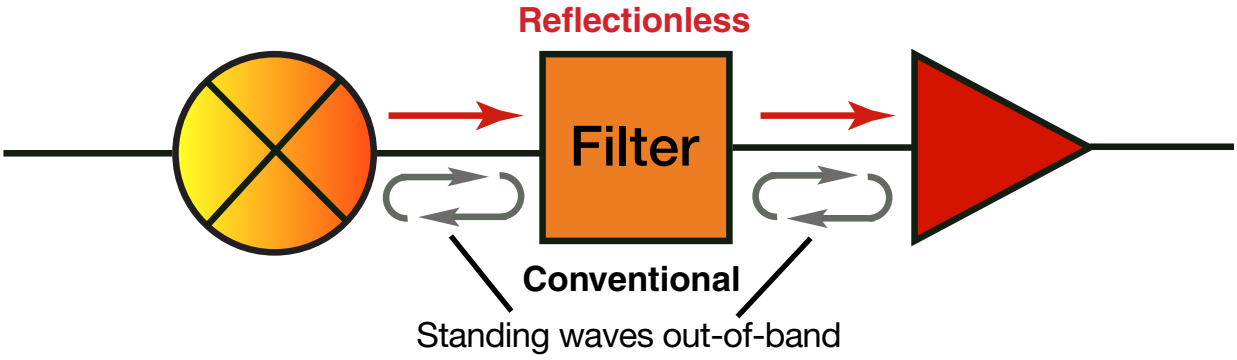

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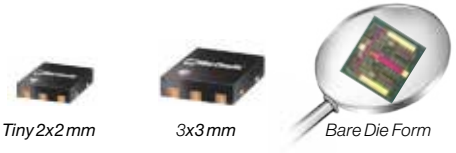

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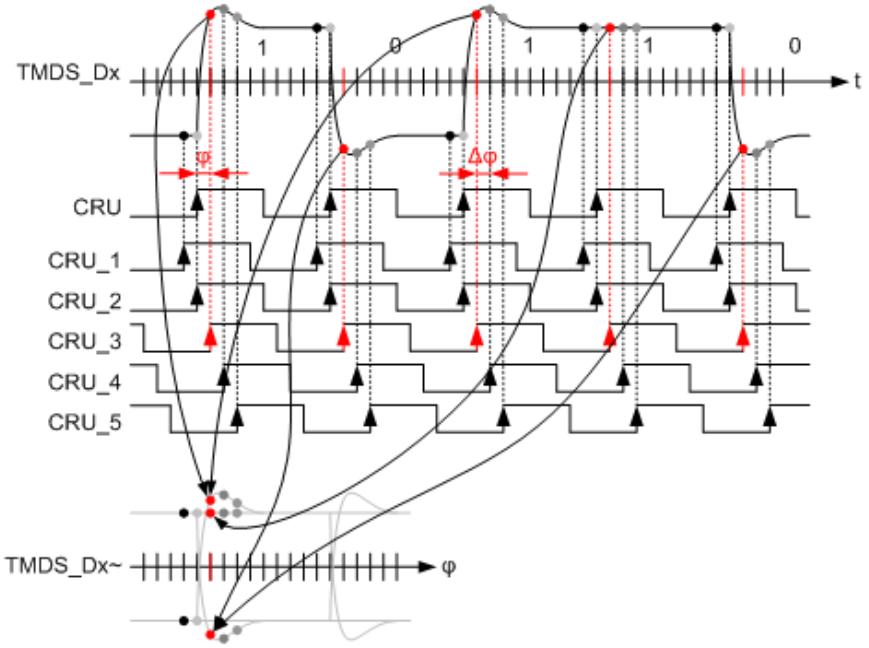


Fig. 5: Principle behind subsampling

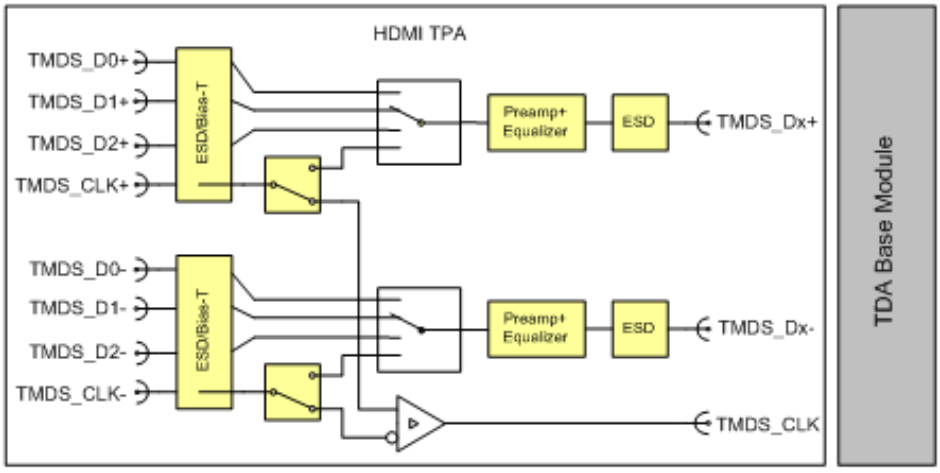


Fig. 6: Block diagram of the HDMI test point access adapter

CRU, but can also be additionally varied in phase φ. During subsampling, the phase is varied in steps Δφ and a certain number of samples is taken for each phase value. (CRU_1, CRU_2,…) The result is a scatter plot of samples that is clearly associated with one phase value.

The figure illustrates the process for CRU_3. During the measurement, the phase φ remains constant. A sample is taken at each rising edge of CRU_3 (five samples in total in this example) and then drawn into the reconstructed waveform TMDS_Dx~, indicated by arrows. As can be seen here, samples 1 and 3 coincide, as do samples 2 and 5. As soon as the desired number of samples has been taken, the phase is increased by one step Δφ and the process repeated. (CRU_4, etc.)

In practice, the phase steps Δφ are minimized such that a continuous impression is generated and the signal waveform is reconstructed cleanly.

In contrast to the RT scope, for subsampling the CRU must be implemented in hardware. A later software calculation is no longer possible because the Nyquist criterion is intentionally violated.

The intentional violation of the Nyquist criterion means that subsequent signal processing of the eye diagram is possible only to a very limited extent. If, for example, the input data is unknown (which is the case with HDMI), a given frequency response cannot be calculated in the eye diagram.

R&S®VT-B2380 TMDS time domain analyzer

The TMDS time domain analyzer (TDA) is a sampling oscilloscope (an oscilloscope that uses the subsampling principle) that has been optimized for HDMI requirements. It consists of an HDMI test point access adapter (TPA) and a base module.

The portion of the HDMI TPA adapter block diagram relevant to the eye diagram measurement is shown in Fig. 6. For the eye measurement, the HDMI TPA adapter is connected to an HDMI source. The adapter communicates with the HDMI source and brings it into a state where data is output to the TMDS-Dx differential pairs. The HDMI TPA adapter

automatically selects one of the four TMDS differential pairs and connects it via the cable to the TDA module, saving the user from having to move the connection. The equalizer and amplifier compensate for the cable frequency response. The TMDS wires must be terminated appropriately for both AC and DC. The probe ensures the correct termination.

The block diagram for the TDA module is shown in Fig. 7. The differential input signal TMDS_Dx+/– from the HDMI TPA adapter passes over an optional termination directly to a fast sampler with >15 GHz analog bandwidth. The sampler uses sample frequency fS to obtain the signal value and holds it until the downstream ADC has converted the value.

	HDMI 1.X	HDMI 2
f_{TMDS_CLK}/MHz	25…340	85…150
f_{TMDS_DATA}/Gbit/s	0.25…3.4	3.4…6
$f_{TMDS\_DATA}/f_{TMDS\_CLK}$	10	40

Table 1: Frequencies and data rates for HDMI

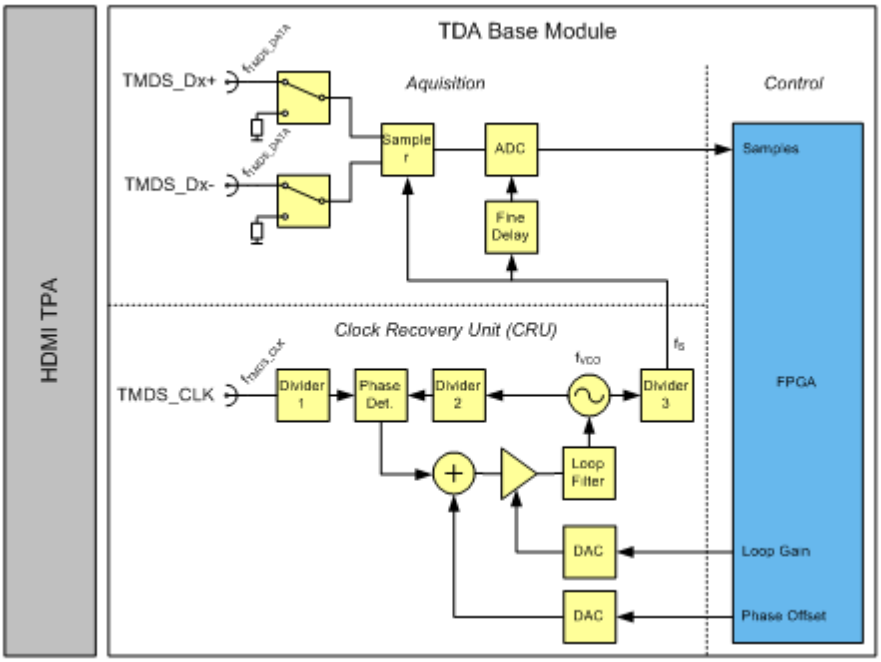


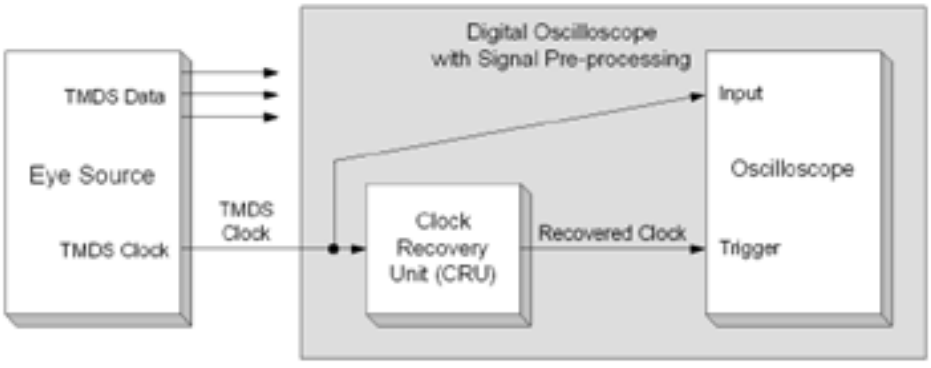
Fig. 7: Block diagram of the base module

The HDMI-specific portion of the TDA module consists mainly of the clock recovery unit (CRU). The clock TMDS_CLK with frequency fTMDS_CLK is in a fixed ratio to the data TMDS_Dx with bit rate fTDMS_DATA. The ratio is different for HDMI 1.X and HDMI 2. The allowed frequencies and bit rates are summarized in Table 1. The ratio between the bit rate fTMDS_DATA and the clock fTMDS_CLK is also known as the serialization factor.

As seen in Table 1, the CRU must work with a wide range of possible input frequencies. The HDMI specification precisely specifies the transfer function for the CRU. According to the standard, a PLL with the following transfer function is required:

$$H(j\omega)=1/(1+j\,\omega/\omega_0)$$
$$,\omega_0=2\pi\cdot 4.0\text{MHz}$$

Equation 2 1: Jitter Transfer Function for ideal recovery clock definition



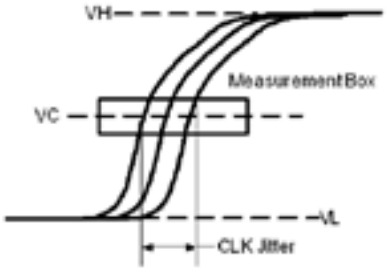


Fig. 2 1: TMDS clock jitter measurement

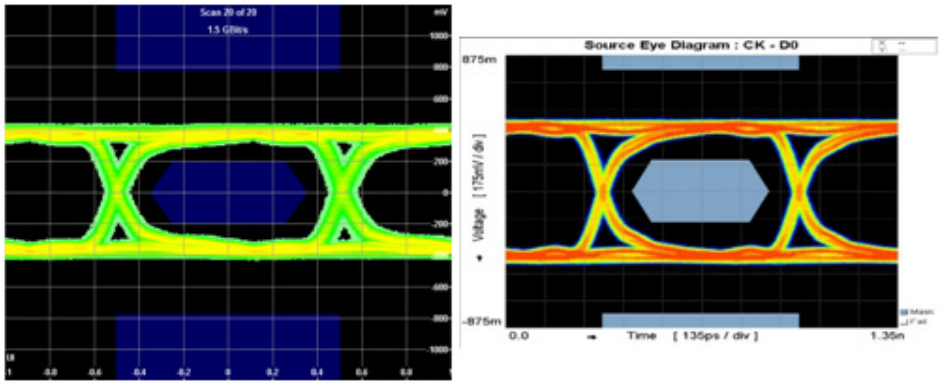


Fig. 8: Media player with fTMDS_CLK = 148.5 MHz

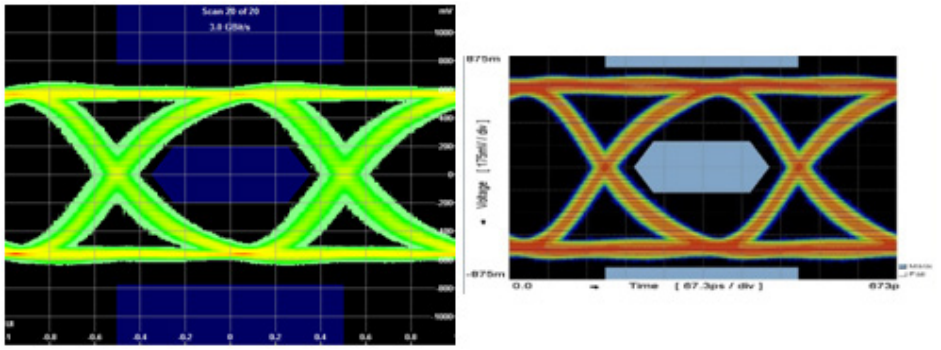


Fig. 9: HDMI generator with fTMDS_CLK = 297.0 MHz

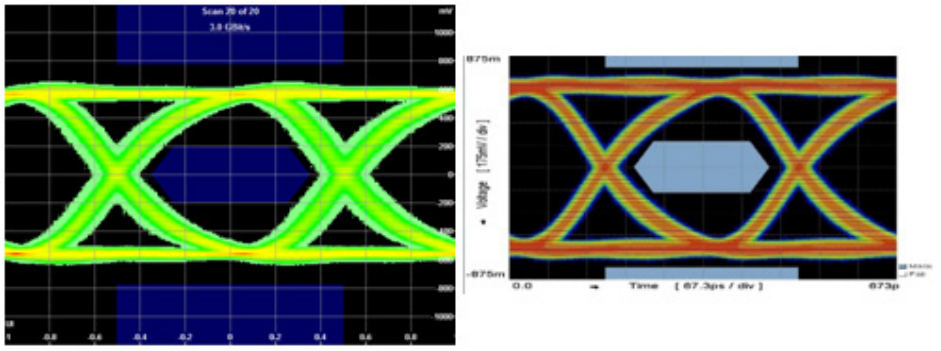


Fig. 10: Media player with fTMDS_CLK = 296.7 MHz

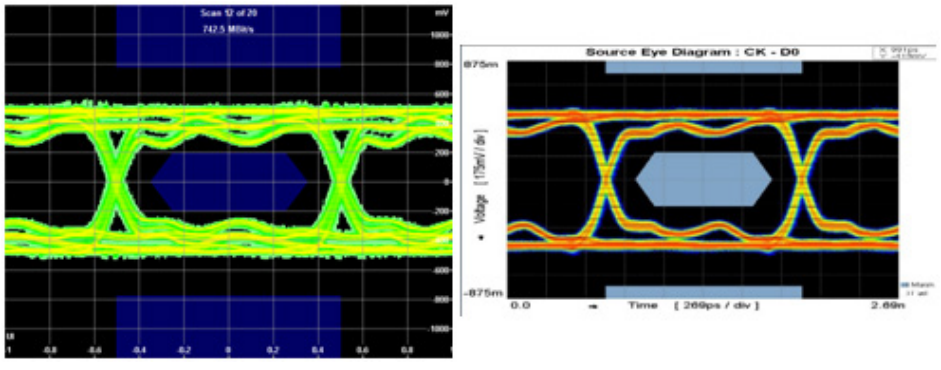


Fig. 11: Receiver with fTMDS_CLK = 74.25 MHz

The clock recovery in the TDA module consists of a PLL that includes the following blocks: divider 1 to 3, phase detector, loop filter and VCO. The PLL uses the input clock fTMDS_CLK to derive the sample frequency fS. The loop filter approximates the transfer function (see formula) as best possible.

The output signal of the phase detector is proportional to the phase between input clock fTMDS_CLK and sample frequency fS. By adding a phase offset Δφ (see Fig. 7) to the output signal of the phase detector, the phase is systematically changed, thereby reconstructing the waveform TMDS_Dx~ step by step as shown in Fig. 5.

The overall module is controlled via the instrument firmware in conjunction with an FPGA.

R&S®VT-B2380 TMDS clock jitter measurement

HDMI defines TMDS clock jitter as the maximum deviation of the TMDS clock signal phase relative to an ideally recovered reference clock. This ideal reference clock can be derived from the clock signal via the clock recovery unit (CRU).

The extent of jitter present in the measured value mainly depends on the measurement time and the CRU's transfer function. The measurement time is determined by the oscilloscope's memory depth and the selected sample frequency. An ideal transfer function has been specified for the CRU (see Equation 2 1).

As explained above, the CRU in the R&S®VT-B2380 is implemented in hardware, not software. Its transfer function only approximates that of an ideal CRU. This means that, depending on the jitter frequency,

there can be deviations in the measurement results compared with a digital oscilloscope. These deviations constitute a measurement uncertainty (see Appendix A).
In addition, the jitter measurement accuracy data in the Appendix takes into account the fact that jitter measurements in the R&S®VT-B2380 are always performed without an equalizer. An equalizer should be used for clock rates higher than 165 MHz in order to minimize the effect of noise on the jitter measurement.
This measurement uncertainty must be taken into consideration when assessing whether the DUT complies with the specification.

Examples

In this section, different HDMI sources are measured with the R&S TMDS time domain analyzer (TDA) and a real-time oscilloscope (RT scope) and the results are compared.

Eye diagram

The results from the TDA are shown below on the left and those from the RT scope on the right.
The measurement results in Fig. 8 and Fig. 9 correlate very well. The amplifiers in the HDMI TPA adapter only negligibly increase the noise in comparison to the RT scope, which does not use amplifiers.
The waveforms in Fig. 10 deviate somewhat from one another. This could be caused by slightly differing termination impedances on the two test instruments.
The waveforms in Fig. 11 deviate significantly. This effect is caused by a strongly fluctuating DC component in the HDMI signal. Because part of the signal is AC-coupled within the HDMI TPA, a varying DC component vertically shifts the reconstructed waveform. This shift cannot be eliminated after the measurement.
It is a characteristic of the transition minimized differential signal (TMDS), although it does not negatively affect differential receivers.
Note: Because this DC component is not optimal for data transmission at high bit rates, HDMI 2.0 introduced scrambling for 6G signals.

Conclusion

Measurement of the electrical characteristics of an HDMI signal using conventional test equipment is both cost-intensive and time-consuming. The process described here permits the implementation of a compact and economical solution that provides information about the physical quality of a TMDS source quickly and without complications.
The implementation using the R&S VT-B2380 TMDS time domain analyzer is additionally combined with a compact TPA adapter. This minimizes the required cabling and eliminates the need to move cables during the measurement. In addition, all required components, including the BIAS-T and EDID source, are already integrated and do not need to be provided externally.
The TMDS measurement offered by the solution additionally covers measurements on the control and communications bus, further reducing the number of required instruments.
The user-friendly R&S VT-B2380 TMDS time domain analyzer guides the user through the measurements so that in-depth knowledge of the individual HDMI-specific measurements is not absolutely necessary. Even the application of the specific EDID to the DUT is performed automatically.
The subsampling measurement principle described here deviates from the process described in the HDMI CTS for determining the electrical quality of HDMI sources. As a result, it is not possible to trigger on data words and to acquire specific signal sequences. However, the procedure does make it possible to assess the quality of an HDMI output in a good approximation of the HDMI CTS requirements.

Reflectionless Filters Improve System IP3 in Up-converter and Down-converter Configurations

› Martina Yan, Mini-Circuits

Since the market release of Mini-Circuits' X-Series reflectionless filters, much testing has been conducted to evaluatethe benefits of these revolutionary products in comparison to conventional filters. While conventional filters are fully reflective in the stopband, reflectionless filters use a novel, patented filter topology to absorb and terminate stopband signals internally, avoiding many known systemic problems caused by reflections in the signal chain. This new capability makes reflectionless filters suitable for a variety of applications beyond those typically incorporating conventional filters. One of the most prevalent and practical of these applications is filtering at mixer inputs and outputs. Previous testing, which Mini-Circuits has published, established that reflectionless filters virtually eliminate signal reflections between the filter and the mixer output as compared to conventional filters.The expected effect of this reduction is an overall improvement is system linearity and dynamic range, but this was inferred in previous reports.

This article will present new test results demonstrating overall improvement in system IP3 when reflectionless filters are used on mixer inputs and outputs in both downconverter and upconverter configurations in comparison to conventional lumped element filters and LTCC filters. The results also expand on previous comparisons by testing numerous mixer-filter combinations and showing consistent performance improvement when reflectionless filters are used.

Up-Conversion Test Setup

Two-tone intermodulation tests were performed in up-converter configuration using diode based mixers with a variety of filters on the IF input and RF output ports for comparison. The test was also performed without filters to provide a reference.Third order intermodulation measurements were made withIF input of 150 MHz and two-tone spacing of 1 MHz, and RF outputs of 800 MHz and 2200 MHz. The test setup is illustrated in Figure 1, and the test conditions are summarized in Table 1.

Each of the two mixers was tested

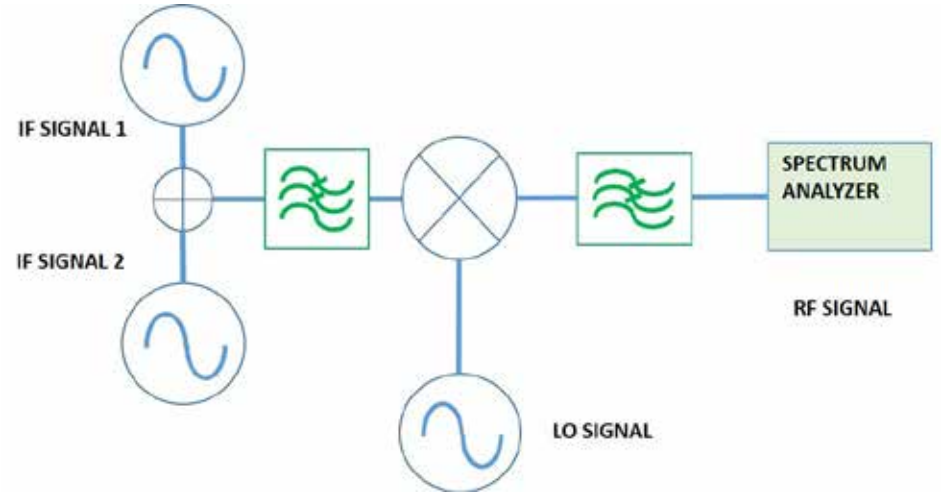


Figure 1: Up-conversion test setup

Table 1: Summary of Test Conditions for Two-Tone Intermodulation Test in Up-converter Configuration				
FILTER POSITIONS	• Case 1: NO FILTERS • Case 2: REFLECTIVE FILTERS (VARIOUS) on RF and IF PORTS • Case 3: REFLECTIONLESS FILTERS on RF and IF PORTS			
IF INPUT	150 MHz			
TONES	TWO TONES SPACING: 1 MHz (149 MHz AND 150 MHz)			
MIXERS TESTED	•ADE-10H+ •SYM-30DHW+			
FILTERS TESTED	LUMPED ELEMENT (Sharp Filters)			
	RF	SLP-1000	IF	SLP-150+
		SLP-1200+		
		SLP-2400+		
		SLP-2950+		
	LTCC FILTERS (Shallow Slope)			
	RF	VLF-800+	IF	VLF-160+
		VLF-1000+		
		VLF-2250+		
		VLF-2500+		
	REFLECTIONLESS FILTERS			
	RF	XLF-861+	IF	XLF-151+
		XLF-122+		
		XLF-252+		

with no filters, reflective filters (lumped element and LTCC), and reflectionless filters at the IF input and RF output ports. Low and high third order intermodulation frequencies were measured at the RF output for all cases and compared. Summary results are presented in Table 2. For brevity sake, results are shown here only for RF output of 800 MHz. Results for RF output of 2200 MHz are comparable and are available by request from Mini-Circuits.

Notice that in all cases where reflective filters were used, the filters contribute to a significant increase in thirdorder intermodulation product (IM 3) relative to the IM3 of the mixer when no filters are used. When reflectionless filters are used, however, measured IM 3 is nearly equal to or less than that of the mixer alone. These results therefore demonstrate that using reflectionless filters in the up-conversion circuit achieves an improvement in third order intermodulation performance ranging from about 5 dB to 18 dB relative to performance when conventional filters are used in the same circuit.

Down-Conversion Test Setup

Two-tone intermodulation tests were performed in downconverter configuration as shown in Figure 2. As in the up-conversion setup, different mixer-filter combinations were tested to compare reflectionless filters with various conventional filters. Mixers were also tested with no filters for reference. Third order intermodulation measurements were made for RF inputs of 800MHz and 2200 MHz with two-tone spacing

Table 2: Summary Results of Two-Tone Intermodulation Test in Up-converter Configuration										
Mixer	Test Freq. MHz	Filter Type	IF FIL-TERS	IF FILTER @F1dB MHz	RF FILTERS	RF FILTER @F1dB MHz	IM 3 (dBc) 799 MHz	IM 3 (dBc)802 MHz	ΔIM 3 (dB)802 MHz	ΔIM 3 (dB) 799 MHz
ADE-10H+	149&150	None	-	N/A	-	N/A	72.2	70.4	0.3	0.6
ADE-10H+	149&150	L-C	SLP-150+	155	SLP-1000	950	53.6	52.9	(17.2)	(18.0)
ADE-10H+	149&150	L-C	SLP-150+	155	SLP-1200+	1050	64.7	63.9	(6.2)	(6.9)
ADE-10H+	149&150	LTCC	VLF-160+	160	VLF-800+	950	51.0	50.8	(19.3)	(20.6)
ADE-10H+	149&150	LTCC	VLF-160+	160	VLF-1000+	1100	49.9	79.9	(9.8)	(21.7)
ADE-10H+	149&150	Non-Ref.	XLF-151+	150	XLF-861+	840	71.6	70.1	Rfrnce	Rfrnce
ADE-10H+	149&150	Non-Ref.	XLF-151+	150	XLF-122+	1200	71.8	70.4		
SYM-30DHW+	149&150	None	-	N/A	-	N/A	58.9	59.0	(3.7)	(3.6)
SYM-30DHW+	149&150	L-C	SLP-150+	155	SLP-1000	950	51.3	50.9	(11.8)	(11.2)
SYM-30DHW+	149&150	L-C	SLP-150+	155	SLP-1200+	1050	57.2	56.4	(6.3)	(5.3)
SYM-30DHW+	149&150	LTCC	VLF-160+	160	VLF-800+	950	48.2	48.2	(14.5)	(14.3)
SYM-30DHW+	149&150	LTCC	VLF-160+	160	VLF-1000+	1100	48.6	48.6	(14.1)	(13.9)
SYM-30DHW+	149&150	Non-Ref.	XLF-151+	150	XLF-861+	840	62.5	62.7	Rfrnce	Rfrnce
SYM-30DHW+	149&150	Non-Ref.	XLF-151+	150	XLF-122+	1200	62.8	63.0		

of 1 MHz, and IF output of 150 MHz. The test setup is illustrated in Figure 2 and the test conditions are summarized in Table 3.

Low and high third order intermodulation frequencies were measured at IF output for all cases and compared. Summary results are presented in Table 4. Again, for brevity, only measurements for RF input of 800 MHz are shown here, but RF input of 2200 MHz produced similar results.

Again we see that reflectionless filters achieve a reduction of IM 3 levels when compared to conventional filters in the same circuit. Third order intermodulation performance with reflectionless filters on the mixer RF input and IF output is nearly equal to or slightly better than that of the mixer alone with no filters. This represents an improvement over traditional filters in the range of 5.5 to 12 dB.

Conclusion

Maximizing linearity and dynamic range has always been a goal in RF transceiver design. The IP3 of the mixer itself is one obvious factor limiting system performance, but even the best mixers produce

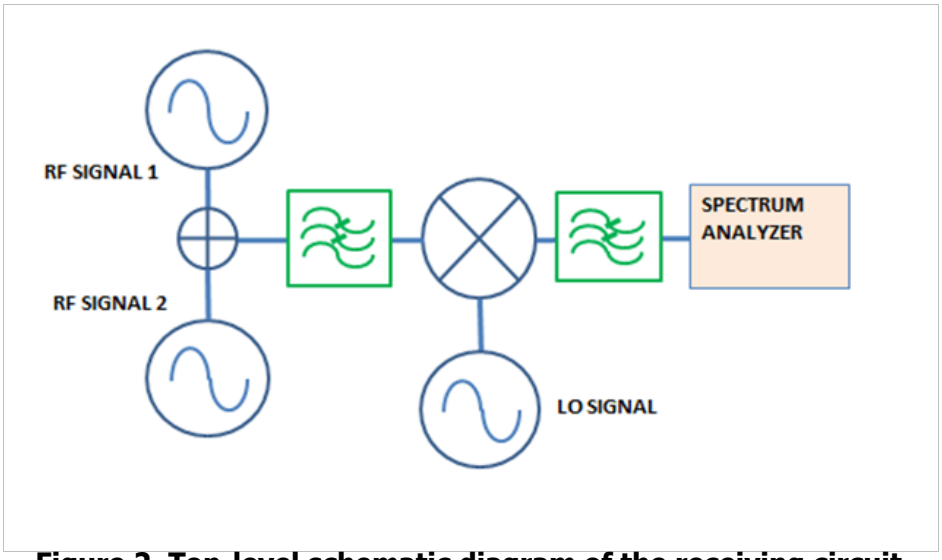


Figure 2. Top-level schematic diagram of the receiving circuit

Table 3: Summary of Test Conditions for Two-Tone Intermodulation Test in Downconverter Configuration				
FILTER POSITIONS	• Case 1: NO FILTERS • Case 2: REFLECTIVE FILTERS (VARIOUS) on RF and IF PORTS • Case 3: REFLECTIONLESS FILTERS on RF and IF PORTS			
RF INPUT	800 MHz 2200 MHz			
TONES	TWO TONES SPACING: 1 MHz	(800 MHz AND 801 MHz); (2200 MHz AND 2201 MHz)		
MIXERS TESTED	•ADE-10H+ •SYM-30DHW+			
FILTERS TESTED	LUMPED ELEMENT (Sharp Filters)			
	RF	SLP-1000	IF	SLP-150+
		SLP-1200+		
		SLP-2400+		
		SLP-2950+		
	LTCC FILTERS (Shallow Slope)			
	RF	VLF-800+	IF	VLF-160+
		VLF-1000+		
		VLF-2250+		
		VLF-2500+		
	REFLECTIONLESS FILTERS			
	RF	XLF-861+	IF	XLF-151+
		XLF-122+		
		XLF-252+		

intermodulation products at some level which can interact with neighboring elements in the RF chain. Since these neighboring elements in real-world systems are often filters, out-of-band signals are fully reflected back into the mixer where they produce a secondary set of spurious signals, which additionally limit the dynamic range of the system.

This has been a longstanding problem in RF system design, against which designers were more or less helpless until recently. Various techniques have been employed to compensate forthe adverse effects of stopband reflections (inserting attenuators or isolation amplifiers around the mixer, for example), but these solutions still degrade system SNR and dynamic range, which becomes self-defeating.

The results presented in this article demonstrate how reflectionless filters may be used with mixers in up-converter and down-converter configuration to absorb those out-of-band signals within the filter circuit itself. In comparison to conventional filters in the same circuit, reflectionless filters achievesignificant reduction of third order intermodulation products, which corresponds to proportional improvement in system dynamic range.

Mini-Circuits offers a wide range of reflectionless filters from stock in tiny QFN packages and bare die form, including low pass, band pass and high pass models with passbands from DC to 30 GHz. These patented products give designers a new tool to achieveperformance improvements similar to those presented here in their own systems.

Important Considerations when Selecting a Fan for Forced Air Cooling

› Jeff Smoot, CUI

Introduction

Designing an appropriate thermal management solution requires a systemic approach; each component on a circuit board will consume some power and, in turn, contribute to the overall operating temperature. Most electronic components are designed to work across a specific temperature range, but each one will have its limits and its own unique thermal profile.

Cooling technology comes in many forms, but all make use of the fundamentals of conduction, convection and radiation for removing unwanted heat. Understanding the thermal path for removing excess heat in a system is the first step towards designing an efficient thermal solution.

In most systems, particularly those that employ an enclosure, some form of forced air cooling will be required to optimize the basic cooling methods available and to ultimately remove heat from the system. Invariably this will involve a fan of some kind and there are now many options to choose from. Selecting the right fan for the thermal management of an enclosed PCB is critical, as its efficiency and effectiveness can have a significant impact on the overall lifespan of a system.

The Cooling Imperative

The heat generated by passive components, integrated semiconductors and other solid state devices is a by-product of their operation. Despite the efforts to produce ultra-low power microcontrollers, the inescapable fact is that the movement of charge carriers in a substrate generates heat. This points a finger at both the cause of the heat and the necessity for effective heat management. Passive devices, predominantly power resistors, have a maximum operating temperature, while most active devices, such as power transistors, can tolerate a maximum junction temperature. In order to avoid cataclysmic failure it is necessary to maintain an ambient temperature low enough to ensure the safe operation of all components in a system.

Conduction of heat away from components throughout the PCB is the simplest means to remove heat. However, when an electronic assembly is placed within an

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Read To Lead

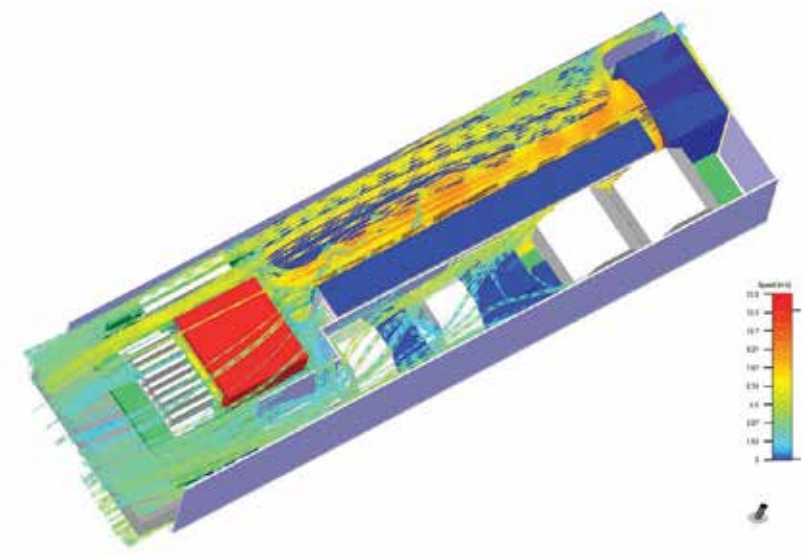

Figure 1: An example of a computational fluid dynamics analysis (CFD) which will provide a very accurate profile of cooling requirements

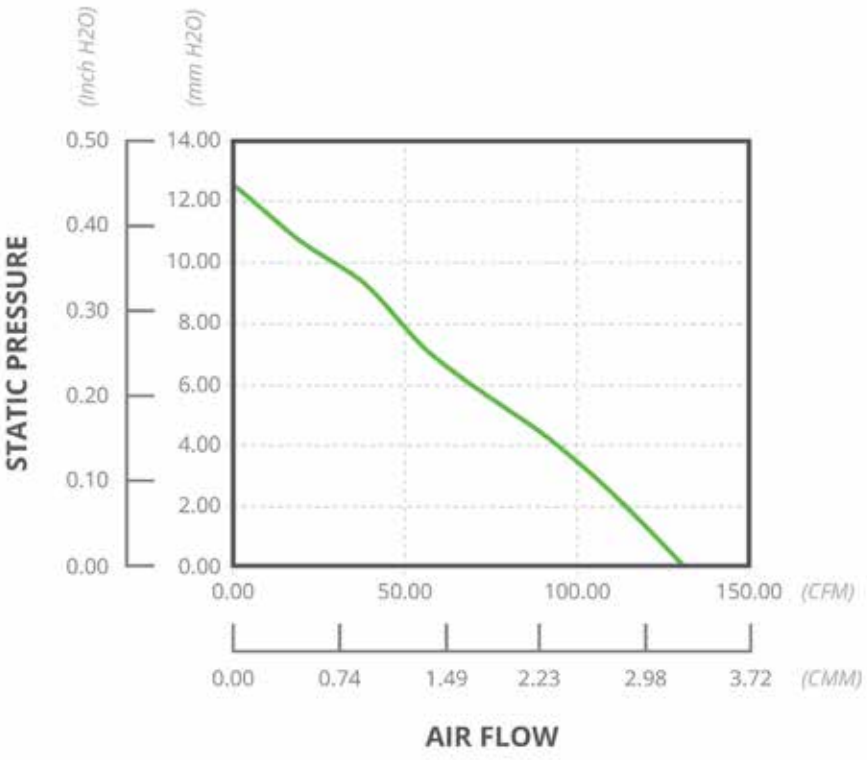

Figure 2: Typical performance curve of an axial fan

enclosure such as a rack-mount, heat dissipation through conduction becomes less effective. For this reason, assemblies that consume as little as 25 W of power may require forced-air cooling.

System Profiling

To design an appropriate cooling solution, it is imperative to create a thermal profile of the system operating under all conditions in order to understand where and how much heat is generated. This can be achieved by using temperature sensors distributed around a PCB and within an enclosure, which provides the data necessary to move to the next stage, defining the amount of cooling required.

Another important aspect of system profiling is determining the amount of impedance to airflow a system exhibits. The system impedance, in terms of a drop in air pressure between inlet and outlet, plays a major part in calculating the overall airflow required from a fan and, in turn, the size and type of fan that should be designed in. Determining system impedance can be achieved by measuring the pressure drop using sensors or, if possible, by placing the system in an air chamber. For larger systems, such as data centers, modeling the system using computational fluid dynamics, or CFD, provides an even more accurate profile of a system's cooling requirements.

Determining Cooling Requirements

As described, effective thermal management of critical electronic components can be achieved using appropriate levels of forced air cooling, but what is 'appropriate'? To answer this, it is necessary to examine and understand by how much the internal temperature can

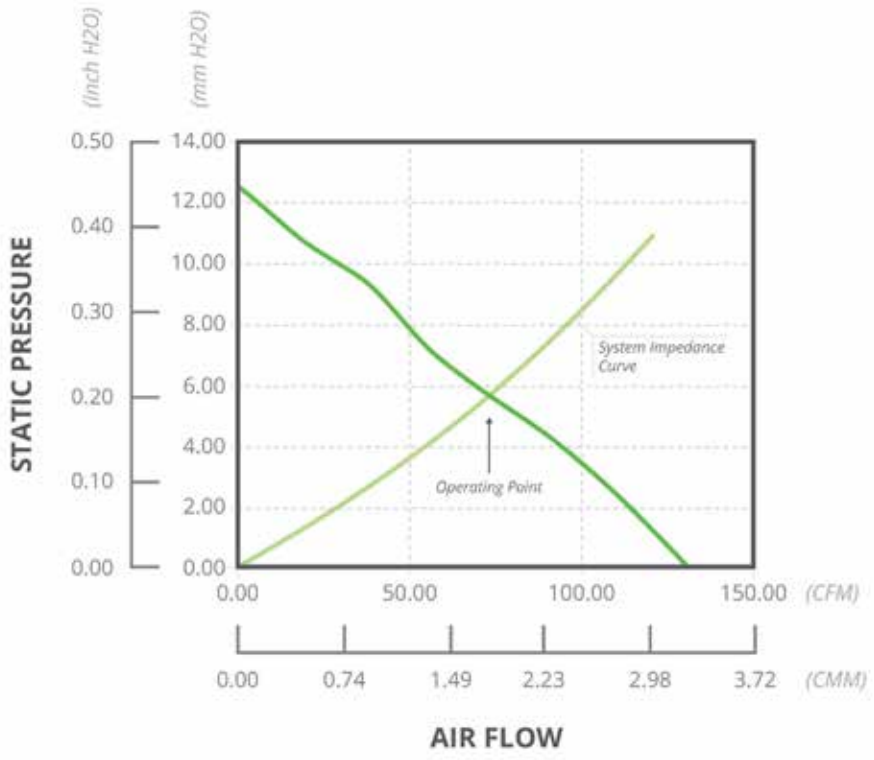

Figure 3: The performance curve of an axial fan with System Impedance plotted, showing the Operating Point

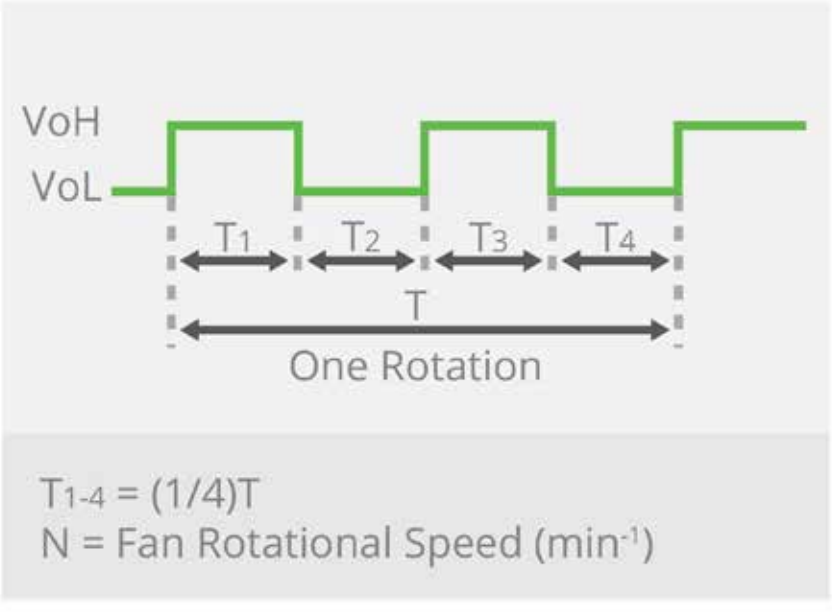

Figure 4: Diagram to illustrate how the signal supports speed detection

change without increasing the risk of failure.

It is important to assess a design to determine the 'most critical' component in terms of operating temperature; this will give a maximum ambient temperature. The cumulative power dissipation for all relevant components, such as power transistors, microprocessors, amplifiers and communication interfaces, will provide a figure for the amount of power dissipated by the overall design.

Power dissipated, in Watts, converts linearly to energy, in Joules/second, which is in turn exhibited as heat. It can be assumed that the temperature of the air around the components will continue to rise all the time the equipment is operating and at some point will reach a level that will inhibit further heat from being removed. Replacing the heated air with ambient air using forced air cooling is clearly the desired effect, which is why it is crucial to specify a fan that can produce the appropriate level of airflow for the system.

Equation 1 shows the relationship between temperature rise and airflow, where q is the amount of heat absorbed by the air (W), w is the mass flow of air (kg/s), Cp is the specific heat of air (J/kg • K) and ΔT is the temperature rise of the air (°C).

Equation 1: Calculating heat absorption

$$q = w \times Cp \times \Delta T$$

Once the maximum permissible temperature within the enclosure is known and the amount of heat

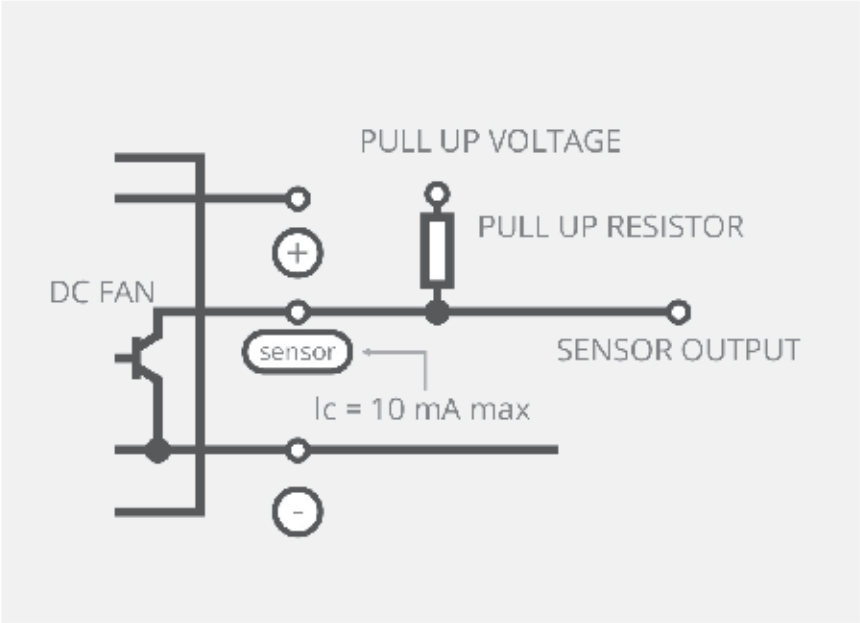

Figure 5: Diagram to illustrate output signal indicating stall/lock fault

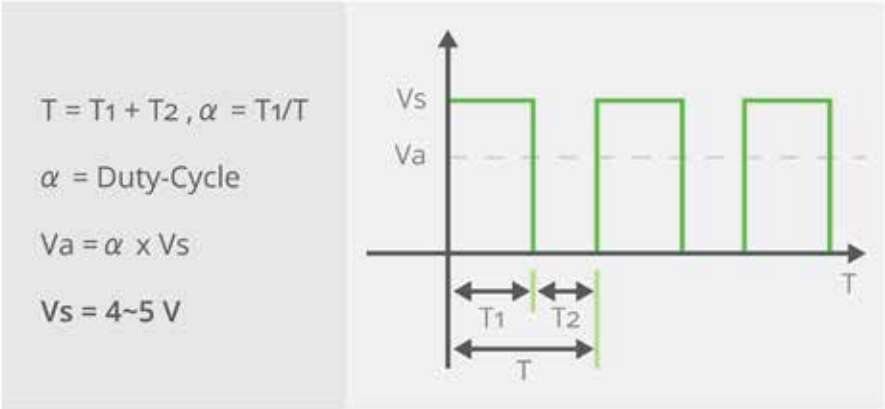

Figure 6: Changing the fan speed can be achieved by changing the duty cycle of the PWM signal

generated is derived (based on the cumulative power/heat dissipated by the components) it is possible to calculate the amount of airflow required. Since mass flow (w) = air flow (Q) x density (**Δ**), substituting and solving for Q we can rewrite Equation 1 to get Equation 2 (where Q is the airflow in CMM (m3/min), q is the amount of heat to be dissipated (W) and **Δ** is the density of air (kg/m3)).

Equation 2: Calculating the amount of airflow required

$$Q=[q/(p \times Cp \times \Delta T)] \times 60$$

Substituting constants for Cp and **Δ** at 26°C, we can arrive at a general equation for calculating airflow, as shown in Equation 3.

Equation 3: Simplified equation for calculating airflow

$$Q = 0.05 \times q/\Delta T; \text{ for Q in CMM}$$

$$Q = 1.76 \times q/\Delta T; \text{ for Q in CFM}$$

The calculated airflow figure can now be compared against the specification for a fan. As shown in Figure 2, manufacturers characterize fans using these two parameters, to provide a performance graph that accurately plots airflow (measured in either Cubic Feet per Minute, CFM, or Cubic Meters per Minute, CMM) against static pressure (measured in either inches or millimeters of water, often written as Inch H2O or mm H2O).

Figure 2 shows the performance curve of the CFM-120 Series from CUI, a 120 mm by 120 mm frame axial fan with dual ball bearing construction. Unfortunately, the result given by Equation 3 is only accurate for 'ideal' conditions; with no back pressure from the enclosure (known as System Impedance, as covered earlier). In reality there will always be some system impedance, so in order to determine the real world requirements it is paramount to calculate or estimate the system impedance. This can then be plotted on the fan's performance curve (Figure 3) and the point at which they cross should be taken as the

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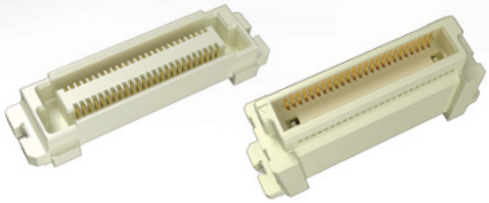

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operating point for the fan.

As outlined earlier, measuring the airflow through an enclosure can be achieved using an airflow chamber, but if that is not an option the alternative is to specify the operating point above the figure derived from Equation 3. For example, if the airflow calculated is 50 CFM with zero back pressure, over-specifying the fan such that it produces a maximum of 100 CFM with the intention of operating it at 75 CFM would provide a good margin of error, as well as some headroom for increasing airflow during operation.

Taking steps at the design stage to decrease or minimize system impedance can clearly be beneficial in terms of specifying the size and power of a fan. At a minimum, it is good practice to keep the areas around the air inlet and outlet as clear of components as possible and to consider the additional system impedance a filter will introduce. Component placement on the PCB should encourage airflow to and around critical components, using guides if needed.

In addition, it should be appreciated that the above equations also use air density at sea level. If a system is expected to be used at altitudes significantly above sea level it is crucial that this is taken into account. Air density reduces with altitude, so a significant increase in altitude would result in a correspondingly significant increase in airflow required to maintain the same level of cooling.

Choosing the Right Fan Design

As well as being available in both ac and dc configurations, fans are generally categorized by the way the air enters and leaves the fan; if it exits in the same plane as it enters it is normally termed an axial fan, as to draw air in from one side and expel it from the other. If the airflow leaves in a different plane it is normally referred to as a centrifugal design, as the air drawn in changes direction inside the fan and is expelled in a different direction. This style of fan can effectively compress the air, allowing it to deliver a constant airflow under different pressures. Perhaps the most prolific centrifugal fan design is the blower, which resembles an axial fan but typically expels air at 90° to the intake.

The volume of airflow needed and the static pressure of the system will influence the most appropriate style of fan for a given application. Axial fans are predominantly suitable for high airflow in systems with low static pressure, while centrifugal fans offer lower airflow, but can deliver it against higher static pressure.

Both audible and electrical noise are also important considerations when selecting a fan. While the advantages of using a dc fan have been touted above, often these benefits are in direct competition with the audible noise generated by their operation. The general rule of thumb being the greater the airflow required, the greater the audible noise. Thus, axial fans will typically have lower audible noise than a blower. Careful design to optimize airflow and reduce system impedance, thus reducing the required CFM, are critical in order to minimize the audible noise generated.

In addition to audible noise, dc fans can have other unwanted system effects. The dc motor within the fan does create an electromagnetic interference (EMI) signature. EMI generated by the fan is normally limited to conducted EMI in the power leads. This can generally be effectively suppressed with ferrite beads, shielding or filtering. For most PCB based systems in an enclosure, the dc axial fan provides the right balance between cost, audible noise, electrical noise (EMI) and performance.

There are differences in the construction of axial fans that may also be relevant depending on the application. Specifically these differences relate to the bearings, which are either steel ball bearings or sintered powdered bearings, usually referred to as sleeve bearings. At consistently low temperatures, sleeve bearings can operate as well as ball bearing fans, however at variable or high temperatures ball bearings have been shown to operate longer and more reliably. Sleeve bearing fans, which are normally cheaper than ball bearing fans, do have their place, but their relatively shorter lifetime and propensity to failure at high temperatures limits their overall suitability.

Active Control and Variability

Axial fans are widely used in rack-mount enclosures thanks to their combination of small size, low power and high airflow. Many also include additional features that can further improve system performance by providing greater

control over the speed of operation, thereby optimizing a design for overall power consumption. As described, calculating the minimum airflow rate required to cool a PCB housed within an enclosure allows for the specification of a fan that can deliver adequate cooling under all conditions. This assumes that the fan will run constantly, even when maximum cooling is not required. While this is not likely to result in failure, it does assume worst-case conditions at all times and is therefore inefficient from a system point of view and will also reduce the operating lifetime of the fan.

Because of this it has become common practice to monitor the temperature within an enclosure and only turn a fan on when it is required. While this approach can improve the lifespan of the fan and reduce audible noise, it can present problems in terms of thermal lag. It can also introduce a fault condition if for some reason the fan is unable to start due to an obstruction in the fan.

To address this, modern dc axial fans like the CFM Series from CUI include auto-restart protection as a standard feature. This feature detects when the fan motor is prevented from rotating and automatically cuts the drive current. Models including the CFM-60 Series also offer optional controls such as tachometer and rotation detection sensors. The tachometer detects the rotational speed of the fan motor and provides a pulsed output that can be used within control circuitry (see Figure 4). If the motor stops, the output stops pulsing and stays at either a logic high or logic low. The rotation detection feature doubles as a lock sensor; if the fan motor stops, the output is driven to a logic high and remains at a logic low during normal operation (Figure 5).

In addition, there is the ability to control the speed of the fan using Pulse Width Modulation (PWM); the duty cycle of this input determines the speed of the fan's rotation, the relationship between the duty cycle and whether the fan's speed is linear. When used in conjunction with a simple algorithm running on a microcontroller it is possible to create a sophisticated thermal management solution that can adapt to system conditions and provide more efficient operation.

A simple example of implementing fan control could consist of a single or multiple temperature sensors distributed around a board. Many modern ICs now include temperature sensors, which can be used for this purpose. Using zones provides greater visibility into the system, particularly for components most susceptible to heat variations. As soon as the measured temperature approaches a predetermined level, the fan can be turned on or speed can be increased by changing the duty cycle of the PWM signal to provide the necessary cooling (see Figure 6). Correspondingly, the fan's speed can be reduced if the internal temperature is below an acceptable level.

Conclusion

Forced air cooling is an efficient way of implementing effective thermal management for an enclosed PCB and choosing the correct fan for the application is vital. With semiconductors and PCBs becoming ever more complex and dense, if a component fails, statistically it will be because it overheated or operated for too long at a critical junction temperature. If the level of forced air cooling is insufficient for the system's needs, the fan will most definitely be the main cause of failure, even though that failure will typically manifest itself as some other critical component failing. With so much to risk, selection of the right fan should not be approached casually and can be the difference between a premature failure and an efficiently operating system.

Discover New Possibilities with the Samsung Galaxy S8 and S8: Smartphones Without Limits

Samsung Electronics Co., Ltd. introduces the Galaxy S8 and S8+ to the world, a smartphone that pushes the boundaries of traditional smartphones with its seamless hardware design and a variety of new service offerings. With the launch of multiple services and apps, as well as a stunning Infinity Display for immersive viewing experiences, the Galaxy S8 and S8+ bring a new level of functionality and convenience, opening up a galaxy of possibilities.

"The Samsung Galaxy S8 and S8+ usher in a new era of smartphone design and fantastic new services, opening up new ways to experience the world," said DJ Koh, President of Mobile Communications Business, Samsung Electronics. "The Galaxy S8 and S8+ are our testament to regaining your trust by redefining what's possible in safety and marks a new milestone in Samsung's smartphone legacy."

See and Experience More

The Galaxy S8 builds on Samsung's heritage of creating stunning designs and functional devices. Available in 5.8-inch Galaxy S8 and 6.2-inch Galaxy S8+, the Infinity Display and bezel-less design form a smooth, continuous surface with no buttons or harsh angles. The result is a truly immersive viewing experience without distractions and makes multi-tasking more convenient. The Galaxy S8's compact design enables comfortable one-handed operation and Corning® Gorilla® Glass 5 on both the front and back for durability and a high-quality finish.

The Galaxy Foundation

In addition to the new design innovations, Samsung continues to deliver cutting-edge technology including an advanced camera, enhanced performance and more to the devices that users love, including:

• Premium Camera: The Galaxy S8 and S8+ are equipped with an advanced 8MP F1.7 Smart autofocus front camera and 12MP F1.7 Dual Pixel rear camera for the best low-light, zoom and anti-blur photos with enhanced image processing.

• Powerful Performance: Packing powerful performance and connectivity, the Galaxy S8 and S8+ feature the industry's first 10nm processor, enabling heightened speed and efficiency. It is also gigabit LTE and gigabit Wi-Fi ready with support for up to 1 Gbps so users can quickly download files, regardless of the file size.

• Robust Entertainment: As the world's first mobile device certified by the UHD Alliance as MOBILE HDR PREMIUMTM, Galaxy S8 and S8+ let you see the same vibrant colors and contrasts that the filmmakers intended while watching your favorite shows. In addition, the Galaxy S8 and S8+ offer next-level gaming experiences with vivid and superior graphic technology, as well as Game Pack, featuring top game titles, including select titles supported by the Vulkan API.

• Global Standard in Mobile Security: The Galaxy S8 and S8+ are built on Samsung Knox, a defense-grade security platform. In addition, the Galaxy S8 and S8+ will offer a wide selection of biometric technologies including a fingerprint scanner, iris scanner and facial recognition so users can select a secure biometric authentication method that works best for them.

The Galaxy S8 and S8+ will also come with the foundational Galaxy features that our customers have come to love, including:

• IP68 water and dust resistance
• MicroSD support up to 256GB

• Always-on display
• Fast and wireless charging capabilities

New Way to Interact with Your Phone

Bixby is an intelligent interface that will help users get more out of their phone. With the new Bixby button, you will be able to conveniently access Bixby and navigate through services and apps with simple voice, touch, vision and text commands. At launch, Bixby's Voice function will integrate with several Samsung native apps and features including Camera, Contacts, Gallery, Messages and Settings, with the plan to expand its capabilities to include more Samsung and third-party apps in the near future. Contextual awareness capabilities enable Bixby to offer personalized help based on what it continues to learn about the user's interests, situation and location.

Users can also shop, search for images and get details about nearby places with Bixby's image recognition technology. As the Bixby ecosystem grows, it will connect across devices, apps and services as a ubiquitous interface, and open up new experiences and scenarios to simplify life.

Beyond the Phone Experiences

The Galaxy S8 and S8+ offers robust portfolio of products and services, elevating the both devices experience for premiere mobile productivity and connectivity.

The Galaxy S8 and S8+ unlock the new Gear VR with Controller, powered by Oculus. Enabling convenient one-handed control and navigation, the controller provides better motion interaction when accessing interactive VR content. The Galaxy S8 and S8+ will also connect to the new Gear 360 to create 4K 360-degree videos and 15MP photos.

Leveraging the processing power of the Galaxy S8 and S8+ for enhanced productivity, Samsung DeX is a unique solution that transforms your smartphone into a desktop by providing a secure desktop-like experience. With Samsung DeX, users can easily display and edit data from their phone, making working from a smartphone faster and smarter.

In addition, as more IoT devices enter the market and the connected network becomes more complex, Samsung Connect simplifies smart device management. With Samsung Connect, users can easily activate IoT-enabled devices through a quick three-step configuration process and manage all connected devices through one integrated app.

The Galaxy S8 and S8+ also come with the enhanced Samsung Health service, expanding one of Samsung's most widely used services with 60 million monthly active users and 11 million daily active users worldwide. Samsung Health includes tele-health (U.S.-only), personal coaching, social capabilities that redefine traditional health and fitness.

Users can leave their physical wallet behind with Samsung Pay, turning their Galaxy S8 and S8+ into a digital wallet they can use almost anywhere they'd use a credit or debit card. With more than 870 worldwide banking partnerships, Samsung Pay has processed more than 240 million transactions to date.

New high-performance earphones tuned by AKG by Harman, offering uncompromised audio for unbeatable sound quality, will come as an in-box accessory. These earphones will have a comfortable hybrid canal fit for better noise cancellation and will be made from anti-tangle metal-fabric material.

The Galaxy S8 and S8+ will be available starting on April 21, and will be offered in a rich color palette including Midnight Black, Orchid Gray, Arctic Silver, Coral Blue and Maple Gold.

For additional product information, please visit www.samsungmobilepress.com, http://news.samsung.com/galaxy or www.samsung.com/galaxy.

NXP Accelerates Automotive Software Design with the New S32K Microcontroller Platform Launch

NXP launched the S32K1 family combining a breakthrough suite of automotive grade tools and software in support of a scalable family of ARM Cortex-based MCUs with future-proof features. This combination drastically reduces development effort and time to market in a broad range of automotive applications. With 10 of the top 15 global car manufacturers already using S32K in next-generation vehicles, this platform sets the future direction of automotive ECU development.

The traditional approach for software development has been to rely on AUTOSAR for automotive-grade drivers, however, not all applications require it. The alternative route is self-development, which is labor-intensive, adds qualification requirements and diverts critical resources. As ECU complexity increases, maintaining high-quality software and meeting time-to-market requirements can only be achieved through use of mature, validated sub-system components.

Minimized software complexity

NXP is utilizing its 15+ years of experience in delivering professionally maintained automotive-grade software to minimize development complexity for a broad range of customers regardless of their development approach.

In applications where the use of AUTOSAR is not mandated, NXP is providing an alternative, turn-key option for self-development with a free-of-charge, pre-qualified, automotive-grade software development kit (SDK) that enables rapid prototyping with simple drag and drop functionality. It includes:

MISRA and SPICE Level 3 compliant low-level drivers (LLDs) for all peripherals

Optional application-specific middleware for LIN, NFC and touch sensing

FreeRTOS® operating system

Drivers for complementary NXP ICs for faster application bring-up and production readiness e.g. system basis chip (SBC) drivers

Documented source code and out-of-the-box examples eliminating the need for device documentation during application bring-up

The SDK is pre-installed in NXP's free S32 Design Studio (DS), an Eclipse-based integrated development environment (IDE) supporting multiple compiler and debugger options.

For AUTOSAR applications, NXP standard MCAL and OS support has been expanded with new Complex Device Drivers (CDD) and a new S32K starter kit from ARCCORE®, significantly lowering cost and complexity barriers to adoption. It is available free of charge for evaluation.

Future-proof hardware

Unlike existing solutions that require multiple MCU platforms to cover a similar range, the initial S32K1 family will span 128KB-2MB of flash memory based on high performance ARM Cortex-M cores. All family members include ISO CAN FD, CSEc hardware security, ASIL-B support and ultra-low-power performance. This scalable approach, combined with a common package strategy and production grade software, maximizes reuse allowing customers to react quickly to changing market requirements.

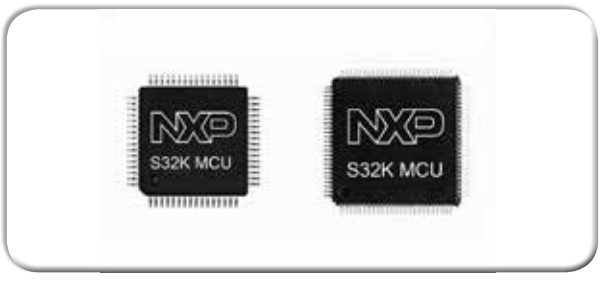
Quotes

"S32K marks an inflection point in NXP's automotive MCU strategy," said Manuel Alves, General Manager GPIS products in NXP's Automotive Microcontroller and Processors Business Line. "We are transitioning from multiple proprietary architectures to a continuous ARM Cortex MCU portfolio combining future-proof hardware with software differentiation."

"The S32K's software and tool support from NXP and multiple ARM ecosystem partners, enables fast time-to-market for developers of all experience levels," said Paul Lee, Global Distribution Marketing Manager for NXP's Automotive Microcontroller and Processors Business Line. "Furthermore, the significant investment in automotive-grade software sets a new standard for an MCU supplier."

Availability

S32K144 samples and a $49 development board are now available with production scheduled for the second quarter of 2017. S32K MCUs are included in NXP's Product Longevity Program which assures supply for a minimum of 15 years. For more information visit www.nxp.com/S32K.



ON Semiconductor Unveils Innovative Modular Automotive Imaging Platform

ON Semiconductor (NASDAQ: ON), driving energy efficient innovations, has introduced the Modular Automotive Reference System (MARS) that gives system and software developers a ready-to-use camera for research and development activities. The leading-edge MARS platform enables users to reconfigure cameras with different lenses, image sensors, image signal processors (ISPs) and communications options for rapid prototyping and experimentation. The system is so flexible that it can be used for the full spectrum of automotive camera applications including advanced driver assistance systems (ADAS), surround and rear viewing systems, in-cabin cameras (for gesture recognition, driver eye monitoring, or light level inspection purposes), and autonomous driving.

MARS enables shorter design cycles, reduced engineering costs, and assists automotive design teams in the implementation of imaging systems by providing them with a unique mix-and-match solution. Through it, various items of hardware can be combined in a robust and highly adaptable system with a compact form-factor. Due to the many different boards available, engineers have access to ON Semiconductor's broad portfolio of image sensors and co-processors, plus various automotive communications protocols from a select group of third party supply partners. This provides extensive scope in terms of finding the combination that best fits specific system requirements. The versatile platform can accommodate an almost limitless number of combinations due to consistent signal/power definitions for the interconnects utilized by these respective boards.

The ease of adapting this modular solution means that undertaking time-consuming activities such as creating custom boards (each capable of accommodating a different sensor option), testing out high-speed interface standards, or writing code for drivers, is no longer necessary. MARS is supported by a complete ecosystem, encompassing software development tools, schematics, gerbers, bill-of-materials (BOM) and much more. A comprehensive user guide is also included within the accompanying documentation.

"As image sensing proliferates in automotive applications, MARS will provide system and software developers tasked with turning concepts into reliable working applications with a valuable platform to simplify and speed proof of concept and development, and offer the scalability to get ideas from the lab to on-vehicle testing in real-world conditions," said Ross Jatou, General Manager and Vice President of Automotive Solutions Division of Image Sensor Group at ON Semiconductor. "The flexibility of MARS accelerates the component selection process by making the constituent sensors and co-processors totally interchangeable. The platform avoids the need to construct a multitude of custom boards to house different sensors for evaluation reducing engineering effort and shortening project times."

The support of commonly used communication standards (such as GMSL, FPD-Link, LVDS, MIPI, Ethernet) enables direct interfacing with existing vehicle electronic control units (ECUs). ON Semiconductor is working with an ecosystem of partners spanning lens developers, third party ISP vendors, communications IC vendors, software developers and SoC vendors. MARS modules are already prequalified with a range of these third party products and the company will expand these offerings going forward.

Replacements for Discontinued Micron Technology Devices

today introduced two new 512Mb synchronous DRAMs (SDRAM) in the 54-pin TSOP II package. The AS4C32M16SB-7TCN and AS4C32M16SB-7TIN are available in commercial (0°C to +70°C) and industrial (-40°C to +85°C) temperature ranges. The devices provide pin-for-pin replacements for Micron Technology's discontinued 32M x 16 MT48LC32M16A2P-75:C (AS4C32M16SM-7TCN) and MT48LC32M16A2P-75 IT:C (AS4C32M16SM-7TIN) SDRAMs. Alliance Memory bought the remaining stock of these Micron Technology 512Mb SDRAMs in 2014.

"We are committed to making the transition to Alliance parts as easy as possible for Micron customers, with no

gap in product availability," said David Bagby, president and CEO of Alliance Memory. "We will continue to sell these SDRAMs with their Micron part numbers while stock lasts, and the Alliance-branded AS4C32M16SM-7TCN and AS4C32M16SM-7TIN will be available while supplies last. The AS4C32M16SB-7TCN and AS4C32M16SB-7TIN ("B die") will be available for at least five years. The devices released today will provide a long-term solution, offering customers pin-for-pin-compatible replacements at a lower cost."

The AS4C32M16SB-7TCN and AS4C32M16SB-7TIN are optimized for medical, industrial, point-of-sale, automotive, and telecom applications requiring high memory bandwidth. The devices operate from a single +3.3V (±0.3V) power supply, offer fast clock rates up to 143MHz, and are lead (Pb)- and halogen-free.

The SDRAMs provide programmable read or write burst lengths of 1, 2, 4, 8, or full page, with a burst termination option. An auto pre-charge function provides a self-timed row pre-charge initiated at the end of the burst sequence. Easy-to-use refresh functions include auto- or self-refresh, while a programmable mode register allows the system to choose the most suitable modes to maximize performance.

Analog Devices Extends Autonomous Driving Leadership with Drive360TM 28nm CMOS RADAR Technology Platform

ADI announced the Drive360TM 28nm CMOS RADAR technology platform that builds on its established ADAS (Advanced Driver Assistance Systems), MEMS, and RADAR technology portfolio widely used throughout the automotive industry for the past 20 years. Analog Devices is the first to offer automotive RADAR technology based on an advanced 28nm CMOS process and the new Drive360 RADAR platform brings unparalleled RF performance to advanced safety and autonomous driving applications. This performance, which exceeds current best-in-class SiGe implementations, is required to see smaller objects further away, thereby giving additional time for the vehicle to take evasive actions. The 28nm technology platform is the foundation upon which multiple products will be developed, an approach that will directly reduce Tier 1 and OEM time to market, design risk and development costs. The new platform supports a host of applications including high-end, long-range use cases required for autonomous driving and ADAS, short to midrange automatic emergency braking, blind spot detection, cross traffic alerts and ultra-short range autonomous parking.

Watch a video to learn more about ADI's autonomous driving solutions

"ADI's primary goal was to deliver next generation autonomous driving-level performance on a platform that could serve multiple system generations by providing the greatest application flexibility and scalability," said Chris Jacobs, general manager, Automotive Safety, Analog Devices. "ADI took a completely fresh look at the current SiGe-based RADAR products and developed a new approach that leverages the cost, power, and integration benefits found in small geometry CMOS. The Drive360 28nm CMOS RADAR platform meets or exceeds current best-in-class SiGe performance and supports emerging autonomous driving requirements."

ADI's Drive360 28nm CMOS RADAR platform enables many high-level signal processing integration options and even allows for custom IP integration enabling designers to differentiate their systems. A highly integrated power management companion chip accompanies the platform. This system brings Tier 1 and OEMs the high performance required to build robust solutions for emerging autonomous driving applications.

Analog Devices' +48V Hot Swap Controller with Digital Power Monitoring Provides Superior Plug-in Board Protection and Minimizes Downtime

ADI announced the availability of the ADM1272, an innovative +48V hot swap controller and PMBus™ power monitor. Designed for high-voltage system control up to 80V, the ADM1272 provides reliable plug-in board protection in mission critical systems, such as servers and communication equipment. Advanced system control and board power monitoring provide superior protection against system faults and system resets from transients up to 120V, which minimizes system downtime and maximizes availability of the system across all conditions. Overall system reliability and MOSFET protection are dramatically increased with the ADM1272's adaptable Safe Operating Area (SOA) protection feature. SOA protection also enables the use of MOSFETs with a smaller form factor and lower cost than traditional hot swap controller solutions. Other performance optimizing features include a PMBus digital interface that provides the system with real time telemetry and fault status information.

In a datacenter, like many communications infrastructures, high availability and reliability is a critical part of the system design. Pluggable modules/PCBs, such as servers and storage, require a protection and control circuit at the power entry point, commonly referred to as a hot swap control circuit. The ADM1272 hot swap controller accommodates supply voltages from 16V to 80V and allows a circuit board to be removed from or inserted safely into a live backplane, eliminating the need to power it down. The ADM1272 also provides system protection from faults such as over current events, voltage transients and short circuits. Other features include current, voltage, power and energy readback using an integrated 12-bit analog-to-digital converter (ADC) accessed using a PMBus interface. This hot swap controller is able to stand off up to 120V making it very reliable by surviving surges and transients and avoiding resets, commonly associated with high voltage systems. Packaging is True High Voltage (80V) IPC-9592 compliant.

Fusible resistors from TT Electronics save PCB space

Radial taped power resistors ideal for minimal footprint designs

TT Electronics, a global provider of engineered electronics for performance critical applications, today launched its ULWP2R range of fusible wirewound resistors. By combining the functions of a fuse and a line input resistor in a single, vertical radial formed component the resistors save valuable PCB space.

The UL recognised, 2W rated power resistors are aimed at designers of high-density PSU circuits where PCB space is at a premium, fusing must be provided, and where automatic insertion is a requirement. For use in both the industrial and consumer sectors, the resistors can be deployed in power supplies, white goods controllers, circuit breakers, line input circuits, protection circuits and other applications.

Factors driving the demand for this type of component are cost reduction re-designs that are increasing both the popularity of dual function components and the automated insertion of parts that cannot be switched to SMD. Further, the increasing electronic content in electrical products is putting pressure on the space available for PSU sections.

With UL1412 recognition, TT Electronics' ULWP2R range of fusible wirewound resistors makes it easier for customers to get UL approval and provides third party assurance of a safety critical part. The resistor's radial, vertical format saves PCB space and also stops surrounding components and the PCB overheating, reducing field failure costs.

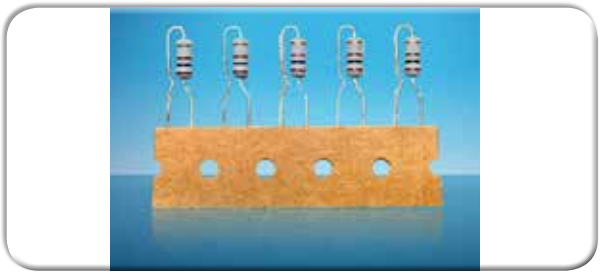
The inrush and surge withstanding resistors provide failsafe mains fusing at 120/240Vrms and they feature a UL94-V0 flameproof coating. Supplied in tape and reel packaging they are ideal for minimal footprint designs

that require flameproof components for automated through-hole assembly, simultaneously reducing assembly costs.

The ULWP2R range of fusible wirewound resistors enables designers to build compact and affordable fire prevention into their products. TT Electronics also offers other 2W rated wirewound and metal film power resistors that are now available in radial taped format including the wirewound high surge WHS series.

For TT Electronics radial taped resistors part selection visit: http://www.ttelectronics.com/resistors/parts-search?combine=radialtaped2W

Download the ULWP2R datasheet here: www.ttelectronics.com/sites/default/files/resistors-datasheets/ULW.pdf



Industry's smallest regulated and isolated 9 W DC-DC converters offer 4:1 input range

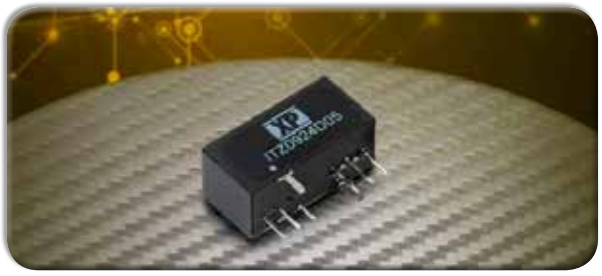
XP Power announced the ITZ series of compact regulated 9 Watt DC-DC converters. Believed to be the industry's smallest 9 W DC-DC converters, the units accommodate an ultra-wide 4:1 input and are available with single and dual outputs. Packaged in an ultra-compact metal cased SIP-8 package measuring just 21.9 x 11.2 x 9.6 mm (0.86 x 0.44 x 0.38 inches), the converters are up to 89 % efficient and have a power density of 44 Watts per cubic inch. With their high efficiency, no additional heat sink components or forced airflow is required, ensuring that the converter occupies the smallest footprint possible, a key criteria of today's space constrained designs.

The series offers two 4:1 input range options of either + 9 to + 36 VDC or + 18 to + 75 VDC, covering all the popular nominal input voltages of + 12, + 24 and + 48 VDC. Single output models are available with + 3.3, + 5, + 9, + 12, + 15, or + 24 VDC. Duals provide +/- 5, +/- 12 or +/- 15 VDC. No minimum load is required.

Input to output isolation is rated at 1.5k VDC across the range, and optionally, 3k VDC isolation is available on –H models. Suiting use in most environments, the ITZ series can operate across the extended temperature range from – 40 to + 85 degrees C and deliver the full output power up to +60 degrees. A remote on/off function provides the ability to externally control the converter such as for sequencing start-up or automatically powering it on or off. All model meets EN55032 level A for conducted and radiated noise without any additional components.

Typical applications for the ITZ series include mobile, portable and wireless products, and any low power use case where isolation and DC voltage conversion is required.

The series is available from Digi-Key, element14, Farnell, RS Components, approved regional distributors, or direct from XP Power and come with a 3-year warranty.



Reinforced isolator with integrated power offers industry's highest efficiency, lowest emissions

Texas Instruments (TI) (NASDAQ: TXN) today introduced a new single-chip reinforced isolator with integrated power that offers 80 percent higher efficiency than existing integrated devices. With the industry's most efficient power transfer, lowest radiated emissions and highest immunity this new reinforced isolator supports reliable operation of industrial systems, including factory automation, grid infrastructure, motor control, isolated power supplies, and test and measurement equipment.

Compared to discrete solutions, the ISOW7841 integrates both isolated data and power, enabling a

smaller bill of materials (BOM) and reduced board space, as well as helping with easier and faster system certification. For more information, see www.ti.com/isow-pr.

Key features and benefits of the ISOW7841

Eighty percent higher efficiency: With the industry's lowest power consumption, the ISOW7841 reduces device operating temperature by up to 40 degrees C, enabling higher power delivery, higher channel count and longer system lifetime than other integrated solutions.

Single-chip reinforced isolated power and data up to 100 Mbps: Combining reinforced isolation and DC/DC conversion in a single package minimizes board space and cost for easier multichannel system design. A working voltage of 1 kVrms helps provide improved system reliability and lifetime. The ISOW7841 supports an input voltage range of 3V to 5.5V, while delivering an industry best 0.65W of output power.

More than 10-dB lower radiated emissions: The ISOW7841 improves system signal integrity by minimizing system noise and providing robust electromagnetic compatibility to meet International Electrotechnical Commission (IEC) 61000-4-x standards for electrostatic discharge and electrical fast transient events. Additionally, the reinforced isolator offers the highest level of immunity available in the market today reducing the effect of noise and high-voltage events on the industrial equipment.

The ISOW7841 reinforced isolator with a three forward/one backward channel configuration is the first device in the ISOW78xx family, with multiple devices expected later in 2017. These new devices join TI's isolation portfolio that supports the highest isolation ratings, reliability, immunity and performance.

Tools and support to speed design

Designers can quickly and easily evaluate the new reinforced isolator with the ISOW7841 evaluation module (ISOW7841EVM), available today for US$49 from the TI store and authorized distributors. Engineers can also jump-start their system design with the integrated signal and power reference designs for isolated RS-485 and RS-232. Additionally, another reference design is available to help integrate reinforced isolation and power in an industrial grid design.

Package, availability and pricing

The ISOW7841 reinforced isolator with integrated power is now available through the TI store and authorized distributors in a 16-pin small outline integrated circuit (SOIC) wide-body package. This device is available in both fail-safe low and fail-safe high configurations. Pricing starts at US$5.50 in 1,000-unit quantities.

Visit TI at APEC

See the reinforced isolator with integrated power and learn about other ways TI is giving engineers the power to innovate, design and learn by visiting booth No. 701 at the Applied Power Electronics Conference (APEC) in Tampa, Florida, March 27-29, 2017.

Vishay Intertechnology High Speed PIN Photodiode Delivers Precise Signal Detection, Enables Slim Sensor Designs for Wearables

Device Offers Enhanced Sensitivity for Visible Light in 5 mm by 4 mm SMD Package With Low 0.9 mm Profile

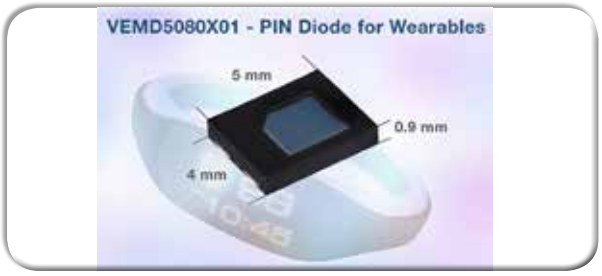
Vishay Intertechnology, Inc. (NYSE: VSH) today broadens its optoelectronics portfolio with the introduction of a new high speed silicon PIN photodiode with enhanced sensitivity for visible light. Offered in a compact 5 mm by 4 mm top-view, surface-mount package with a low 0.9 mm profile, the Vishay Semiconductors VEMD5080X01 offers fast switching times and low capacitance for precise signal detection in wearable devices and medical, industrial, and automotive applications. Offering a large radiant-sensitive area measuring 7.5 mm² — and high radiant sensitivity with a reverse light current of 45 µA and dark current of 0.2 nA — the device released today detects visible and near infrared radiation over a wide sensitivity range from 350 nm to 1100 nm. For green LEDs, the VEMD5080X01's sensitivity represents a 30 % improvement over previous-generation solutions.

When used with Vishay's VLMTG1400 green LED, the photodiode's small size and sensitivity enable slim sensor designs for optical heart rate detection in wearable devices such as fitness trackers and smart watches. When combined

with Vishay's VSMD66694 660 nm and 940 nm dual color emitting diodes, the device is ideal for SpO2 measurement in medical monitors. In addition, it provides high speed photo detection in smoke detectors with dual-wavelength light sources and automotive dust and particle sensors in combination with a red diode.

The VEMD5080X01 features a ± 65° angle of half-sensitivity, a wide temperature range of -40 °C to +110 °C, and 950 nm wavelength of peak sensitivity. The robust device is tested to AEC-Q101 standards for Automotive Grade semiconductors. RoHS-compliant, halogen-free, and Vishay Green, the photodiode provides a moisture sensitivity level (MSL) of 4 in accordance with J-STD-020 for a floor life of 72 hours. Wettable flanks allow for optical solder joint inspection.

Samples and production quantities of the VEMD5080X01 are available now, with lead times of eight to 10 weeks for large orders. Pricing for U.S. delivery only starts at $0.51 per piece.



Industry's first multiphase bidirectional current controller from TI

Texas Instruments (TI) (NASDAQ: TXN) today introduced the industry's first fully integrated multiphase bidirectional DC/DC current controller, which efficiently transfers electric power greater than 500 W per phase between dual 48-V and 12-V automotive battery systems. The highly integrated LM5170-Q1 analog controller features an innovative average current-mode control method that overcomes the challenges of today's high-component-count, full digital control schemes. For more information, samples and an evaluation module, see www.ti.com/lm5170q1-pr.

TI will demonstrate the LM5170-Q1 controller in booth No. 701 at the Applied Power Electronics Conference (APEC) in Tampa, Florida, March 27-29, 2017. The LM5170-Q1 is the latest in TI's portfolio of industry-leading DC/DC converters, controllers and charge pumps, enabling engineers to innovate and differentiate their power supply designs.

Hybrid electric vehicles use both a high-voltage 48-V battery and the standard 12-V automotive battery. Design engineers typically manage these dual battery systems using a digital control scheme, which includes multiple discrete components such as current-sense amplifiers, gate drivers and protection circuits. These full digital control schemes are bulky and expensive. To solve this challenge while improving performance and system reliability, TI offers a mixed architecture in which the microcontroller handles higher-level intelligent management, and the highly integrated LM5170-Q1 analog controller provides the power conversion. Read the blog post, "Interconnecting automotive 48V and 12V rails in dual battery systems," to learn how to overcome the challenges of designing a power supply for hybrid electric vehicles.

LM5170-Q1 key features and benefits

Unique design for optimized system cost and performance: The LM5170-Q1's average current-mode control method improves performance, simplifies implementation and reduces cost. Read the blog post, "Selecting a bidirectional converter control scheme," to find out how TI's average current-mode control method compares to conventional control schemes.

High accuracy: The controller's 1 percent accurate bidirectional current regulation ensures precise power transfer.

Power efficient: The LM5170-Q1 achieves greater than 97 percent efficiency.

High precision: The controller monitors current with up to 99 percent accuracy.

High power: Integrated 5-A peak half-bridge gate drivers for high power capability.

Superior performance: Diode emulation mode of the synchronous rectifier MOSFETs prevents negative current and enhances light load efficiency.

Automotive quality: The LM5170-Q1 is AEC-Q100 qualified.

Download the white paper "Driving the green revolution in transportation," to learn how advanced electronics are increasing the automation, safety, comfort and convenience of electric vehicles.

Availability, packaging and pricing

Available in volume now through the TI store and authorized distributors, the LM5170-Q1 is offered in a 48-pin, 9-mm by 9-mm quad flat package (QFP) and priced at US$5.84 in 1,000-unit quantities. Order the LM5170EVM-BIDIR

evaluation module, and download the PSpice transient model and LM5170-Q1 quick-start DC/DC synchronous buck converter design tool.
Search for and download a power-supply reference design from the TI Designs library.
Search for solutions, get help and share knowledge in the TI E2E™ Community Power Management forum.

STMicroelectronics Launches Tiny 2.6A Brushed DC Motor Driver for Portable, Battery-Powered IoT Devices

The STSPIN250 single-chip 2.6A driver for brushed DC motors extends STMicroelectronics' family of miniature, low-voltage, energy-efficient drivers for battery-powered portable and wearable applications
The driver integrates a full power-MOSFET bridge and fixed off-time PWM current controller in a tiny 3mm x 3mm package that saves space in portable equipment. The low on-resistance of the power stage (200mΩ total, high-side + low-side) and the best-in-the market current-sipping standby mode — below 80nA — help maximize battery runtime and keep equipment-case temperatures down. Its supply-voltage range of 10V to 1.8V allows designers to specify a power source as small as a single Li-ion cell.
Brushed DC motors offer a strong combination of performance, cost-effectiveness, and reliability, and are a popular choice of designers in a wide variety of applications. STSPIN250's high output-current capability allows use in low-to-medium-power applications such as portable printers, POS terminals, consumer devices, electronic valves or door lockers, toys, and medical or wellness devices ranging from electric toothbrushes to syringe pumps. It also has comprehensive built-in protection features including Under-Voltage lockout (UVLO), non-dissipative over-current protection, short-circuit protection, and thermal shutdown.
The STSPIN250 joins the three monolithic, low-voltage drivers for portable and battery-powered applications that ST introduced last year: the STSPIN220 for stepper motors, STSPIN230 for three-phase brushless motors, and STSPIN240 for brushed DC motors up to 1.3A. The STSPIN family now presents designers with a choice of compact, convenient, and energy-efficient drivers for the motor types most commonly used in portable applications, contributing to the widespread adoption of battery-powered IoT devices.
A complete ecosystem is ready to support fast and easy evaluation and prototyping with the STSPIN250, and comprises an STM32 Nucleo expansion board (X-NUCLEO-IHM13A1) and related software tools (X-CUBE-SPN13) that connect motor-control projects with the extensive STM32Cube MCU-development resources.
The STSPIN250 is in production now in the 3mm x 3mm VQFPN package, priced $0.75 for orders of 1000 pieces.

New Yorker Electronics Features Mil-Spec Wet Tantalum Capacitor with Extended Capacitance Range

New Yorker Electronics is now distributing the Vishay tantalum-cased, hermetically sealed wet tantalum capacitor with the new, expanded capacitance ranges. The new device features a wide voltage range from 50V to 100V, high capacitance from 220µF to 680µF, capacitance tolerance of ±10% and ±20% standard and a maximum ripple current of 2750mA. Offered in the axial T1, T2, T3 and T4 case size, the M39006/33 operates over a temperature range of -55°C to +85°C, to +125°C with voltage derating.
It is the industry's first such device to be qualified to the MIL-PRF-39006/33 specification. MIL-PRF-39006 establishes 1000h failure rate levels of 1%, 0.1%, and 0.01%. For designers, the M39006/33 (Style CLR93) offers established reliability for critical avionics and aerospace systems. The device combines its high capacitance and

high reliability with excellent reverse voltage, vibration and thermal shock performance.
Optimized for timing, filtering, energy hold-up and pulse power applications in power supplies for space and avionics equipment, the M39006/33 allows designers to incorporate fewer capacitors into these products to lower overall system costs.
Product Benefits:
Qualified to the MIL-PRF-39006/33 specification
Extended capacitance range from 15µF to 680µF
Provides established reliability
Hermetically sealed
Tantalum cased
Axial lead
Wide voltage range from 50V to 100V
Market Applications:
Power supplies for space and avionics equipment – timing, filtering, energy hold-up, and pulse power applications
New Yorker Electronics is a franchise distributor for Vishay Semiconductors and carries the full line of 2016 Vishay Super 12 Featured Products as well as its full line of discrete semiconductors (diodes, MOSFETs and infrared optoelectronics) and passive electronic components (resistors, inductors and capacitors).

NXP Announces ARM Cortex-M4-based MCU with Industry's Largest Embedded SRAM Memory, Optimized for Portable Devices

NXP Semiconductors N.V. (NASDAQ:NXPI) announced its new Kinetis K27/K28 family of ARM® Cortex®-M4-based microcontrollers (MCUs) that uniquely address the growing requirements of portable display applications. The latest 150 MHz Kinetis MCUs enable advanced integration in battery-operated applications, with an increase of up to four times the embedded SRAM offered in current MCUs, and 2MB of Flash memory. Its large memory, coupled with expanded integration capabilities and lower system power enable richer graphics and longer battery life to optimize the user experience in a broad range of use cases.

"Embedded designers can now push the limits of integration to create more competitive products with NXP's new Kinetis K27/K28 MCUs, which makes it possible for them to get the most out of their devices," said Geoff Lees, senior vice president and general manager of the microcontroller business line at NXP. "Our new high-performance microcontrollers enable enhanced user interfaces and high-end customized apps while extending battery life, all of which are important when it comes to product differentiation for IoT devices, smart home products, wearables and industrial portable devices."
The 1MB embedded SRAM enables lower system power and larger graphics buffer sizes to deliver both power efficiency and high performance; this enables users to install more software applications and apps on wearables, and other portable graphic display systems. The advanced integration also reduces system board footprint addressing the need for portable devices to have small form factors.
The latest Kinetis K27/K28 MCUs support a broad set of peripherals, including low-power peripherals to optimize battery life, dual USB controllers for high speed data transfer, external memory interfaces for additional program and data storage, and analog or other peripherals to process sensors in connected IoT devices.
The Kinetis K27/K28 is supported by a FRDM-K28F low-cost development platform that includes on-board discrete power management, accelerometer, QuadSPI serial flash, USB high-speed connector and full-speed USB OpenSDA. The FRDM-K28F board also supports optional add-on boards to add USB-Type C and Bluetooth® low energy (BLE) connectivity, as well as a 5" LCD display board with capacitive touch from MikroElektronika for use cases requiring rich graphics. Dr. Djordje Marinkovic, MikroElektronika Chief Business Development Officer, said, "As a valued NXP partner, our TFT Proto 5" CAPACITIVE board extension brings to life a sophisticated visual display enabled by NXP's new Kinetis microcontrollers."
Additionally, NXP provides a comprehensive software tools through its MCUXpresso SDK that provides software enablement for NXP Microcontrollers, including

system startup, peripheral drivers, USB and connectivity stacks, middleware, and real-time operating system (RTOS) kernels.

Availability

The new Kinetis K27/K28 MCU family will be commercially available in April 2017.

See NXP Technologies in action at Embedded World 2017 in Nuremberg, Germany

Visit NXP during Embedded World in Hall 4A – 220 at the Exhibition Centre Nuremberg. Interact with innovative demonstrations for embedded solutions enabling the IoT from smart cars to smart industry.

Allegro MicroSystems, LLC Announces New Three-Phase BLDC Controller and MOSFET Driver IC

Allegro MicroSystems, LLC announces a new three-phase brushless BLDC motor controller for use with N-channel external power MOSFETs. Allegro's AMT49413 incorporates much of the circuitry required to design a cost-effective, three-phase motor drive system with maximum supply voltages up to 50 V. This new device is targeted at high current BLDC motor applications for speed, position, or torque control requirements. It has been designed for battery powered power tools, lawn and garden equipment and factory automation, pumps, fans, blowers and appliance applications within the consumer and industrial markets.

The AMT49413 provides functionality over a wide input supply range. A unique charge pump regulator provides adequate (>10 V) gate drive for battery voltages down to 7 V, and allows the device to operate with a reduced gate drive at supply voltages down to 5.5 V. A bootstrap capacitor is used to provide the above-battery supply voltage required for N-channel MOSFETs. An internal charge pump for the high-side drive allows for DC (100% duty cycle) operation.

Internal fixed-frequency PWM current control circuitry can be used to regulate the maximum load current. The peak load current limit is set by the selection of an input reference voltage and external sensing resistor. The PWM frequency is set by a user-selected external RC timing network. For added flexibility, the PWM input can be used to provide speed and torque control, allowing the internal current control circuit to set the maximum current limit. Efficiency is enhanced by using synchronous rectification.

A full suite of protection features is provided including MOSFET shoot-through, undervoltage, overvoltage, HALL logic fault, low motor current and short to ground, supply and across motor winding. The dead time can be set by a single external resistor.

The AMT49413 is supplied in a 48-pin QFN with exposed thermal pad. This is a small footprint (7mm x 7mm) power package, that is lead (Pb) free, with 100% matte-tin leadframe plating.

Allegro MicroSystems, LLC is a leader in developing, manufacturing and marketing high-performance semiconductors. Allegro's innovative solutions serve high-growth applications within the automotive market, with additional focus on office automation, industrial, and consumer/communications solutions. Allegro is headquartered in Worcester, Massachusetts (USA) with design, applications, and sales support centers located worldwide. Further information about Allegro can be found at www.allegromicro.com.

Analog Devices' Ultralow Power Accelerometer Enables Remote IoT Edge Nodes to Monitor Asset Health

today announced a next-generation accelerometer designed for long-period monitoring of the physical condition of high-value assets. With its extremely low power capabilities, the ADXL372 micropower high-g MEMS accelerometer targets Internet of Things (IoT) solutions where shock and impact on a unit during storage, transit, or use would adversely affect its function, safety, or reliability. Representative assets include materials inside shipping and storage containers, factory machinery, and battery powered products where there may be lengthy quiet periods punctuated by spontaneous, severe impacts.

View product page, download data sheet, order samples and evaluation boards: http://www.analog.com/ADXL372

Learn about Analog Devices' role in providing critical components, tools, and development tools for high-performance IoT applications: http://www.analog.com/IoT

Connect with engineers and ADI product experts on EngineerZone®, an online technical support community: https://ez.analog.com/welcome

Watch a video about the new ADXL372 MEMS accelerometer: http://www.analog.com/en/education/education-library/videos/5352415518001.html

Unlike comparable sensors, this ultralow power MEMS sensor has an "instant on" feature and can wake up immediately to acquire the entire waveform, which significantly reduces standby power drain. The resulting low current requirement of less than two microamps while waiting for an impact typically yields years of operation from a single small battery when the sensor is used in a motion-activated system. By using the ADXL372 MEMS accelerometer as part of a remote edge-node device in an IoT application, transient events can be captured and categorized by a localized processor beforehand by being sent to the cloud or other data center via a wireless link.

Keeping the analysis localized saves power, time, and prevents unnecessary transfer of data for an event that is actually insignificant.

The wide bandwidth of 3200 Hz and dynamic range of ±200 g make it an excellent fit for a diverse set of asset health-monitoring applications including monitoring of concussions for indication of Traumatic Brain Injury in both athletes and military personnel.

The ADXL372, specified over the -40C to 105 ºC range, joins the industry-leading ultralow power, low g ADXL362 MEMS accelerometer as part of ADI's broader ultralow power portfolio of sensors. Both the ADXL372 and ADXL362 accelerometers interface seamlessly with the ultralow power ADuCM4050 microcontroller, which was recently added to the series of IoT-optimized microcontrollers. Other leading-edge microcontrollers include the ADuCM3027 and ADuCM3029; all of these devices feature both active and hibernate modes with ultralow power demands, and target applications where power consumption, security, and robustness are key requirements.

The Industry's First MCUs with Built-In LCD Driver Optimized for Data Loggers

ROHM Group company LAPIS Semiconductor has recently announced the availability of 32bit microcontrollers ideal for data loggers used in logistics for acquisition and management of environmental information during package shipment.

ROHM will exhibit the new device at Embedded World in Nuremberg (March 14-16), Hall 3A, Booth 320.

The ML630Q464/466 are the first ICs in the industry to integrate all major functions required for data logging (USB, high-speed clock generation, LCD driver, high-accuracy RC oscillation type AD converter), data acquisition (i.e. temperature, humidity, acceleration), data display, and PDF file generation on a single chip.

In recent years rising concerns about the safety and security of foods and medicines have expanded the use of logistics systems to maintain cold temperatures

(cold chain) without interruption, from production to transportation and consumption, particularly for perishables and pharmaceuticals. Consequently, in the logistics industry it will be necessary to manage the transportation environment that affects package quality – namely temperature, humidity, and shock/vibration. This is expected to increase demand for management tools such as data loggers by more than 10% per year.

For data loggers, which are typically attached to packages and in many cases disposable, it is important to reduce both size and cost by utilizing smaller batteries along with fewer parts. In addition, operating guidelines such as FDA*2 regulations on cold chain and GDP*3 require reliable recording of package conditions during transport and the output of uneditable PDF files to prevent tampering of records (log data).

In response, the ML640Q464/466 provide PDF file generation and integrate key functions for USB data logging on 1 chip while leveraging LAPIS Semiconductor's expertise in low power consumption, high noise immunity, and high performance. These new MCUs utilize an ARM Cortex M0+ 32bit CPU core to achieve high performance with low power consumption. Log data can be easily converted to PDF in about 4 seconds and operation is enabled for up to 380 days*1 using a single coin battery. In addition, the products inherit LAPIS Semiconductor's robust noise immunity, making it possible to achieve stable operation even under severe conditions.

LAPIS Semiconductor strongly supports IoT solution suppliers in supply chain and logistics with comprehensive reference design using LAPIS Semiconductor's advanced low power technology based high performance MCUs and wireless communication LSIs.

Key Features

All major USB data logger functions integrated on one chip, reducing board space by 30%

These ICs incorporate all major features required for USB data loggers, including USB I/F, high-speed clock generator, LCD driver, and high-accuracy RC oscillation type AD converter (ADC).

The ADC provides a temperature measurement accuracy of ±0.5□ using only a thermistor and resistor/capacitor, unlike typical temperature measurement circuits consisting of a temperature sensor, thermistor, and reference voltage generation circuit. This reduces board space by 30% over conventional solutions.

In addition, higher performance is achieved by utilizing an ARM Cortex M0+ CPU core and incorporating an optimized□PDF generation program within the IC that makes it possible to create a single A4 page PDF file with 2,500 measurement points in roughly 4 seconds. Also, combining the customer's AES encryption program with the built-in AES function and random number generator allows users to generate password-protected PDF files. Providing high performance and low power consumption enables operation for up to 380 days with a single coin battery

USB data logger operation is roughly divided into two parts: (1) reading and recording sensor data at specific intervals and (2) generating a PDF file when USB connection is established at the end of use. However, standby current consumption will have a dominant effect on battery life, since most of the time the data logger is in a dormant state.

These new MCUs achieve a best-in-class standby current consumption of 0.8uA by supporting 4 low power modes. As a result, operation for up to 380 days is achieved utilizing a single coin battery (CR2032) with just 1/3rd the capacity of conventional batteries required for MCUs used in typical data loggers.

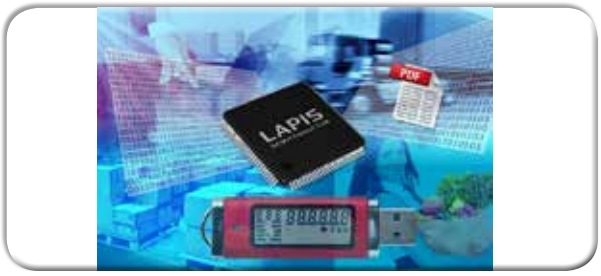
Optional USB Data Logger Reference Kit helps customers accelerate development

A reference kit is provided that supports the development of data loggers using the ML630Q46x. In addition to hardware information such as circuit diagrams and parts lists, the reference kit includes various software code for operating the USB flash memory and generating PDF files, all necessary documentation, and usage methods for power management and the high accuracy RC type A/D converter that facilitate understanding of MCU operation and accelerate customer development.

4□Robust noise immunity (inherited from LAPIS Semiconductor's 'Tough' MCU series) contributes to stable operation even under harsh environments

To protect important log data (for verifying package quality) against external noise these new MCUs inherit original low power consumption and noise immunity technologies adopted in LAPIS Semiconductor's 'Tough

Low Power' MCU series.
The ML630Q46x MCUs have succeeded in clearing ±30kV, far exceeding the measurement instrument limit of test voltage level 4 (±8kV indirect contact discharge) of the IEC 61000-4-2*4 standard established by the International Electrotechnical Commission (IEC). [Measured using the ML630Q466 reference board.] This enables stable operation even under harsh environments.



Intersil Unveils Highly Integrated Multi-Cell Battery Pack Monitor

Intersil, a subsidiary of Renesas Electronics Corporation (TSE: 6723), today announced the ISL94202 3-to-8 cell battery pack monitor that supports lithium-ion (Li-ion) and other battery chemistries used in applications such as vacuum cleaners, lawn equipment, handheld power tools, e-bikes, scooters, toys, and energy storage systems. Li-ion batteries are smaller, weigh less, and deliver longer battery life than other battery chemistries, but require monitoring and protection for safe use. The highly integrated ISL94202 battery pack monitor enables ultra-small 2-terminal designs, and accurately monitors, protects and cell balances rechargeable battery packs to ensure safe operation and charging.
The ISL94202 operates as a stand-alone battery protection system using an internal state machine with five pre-programmed modes for accurately balancing and controlling each battery cell. It monitors and protects the battery pack from catastrophic events such as hardware faults, short circuit conditions, and cell voltage overcharge/over-discharge and meets the UL2054, UL2271/72 and IEC62133 specified pack safety requirements. Designers can program the ISL94202 battery monitor's protection settings to enable the industry's smallest, low-cost battery packs without requiring an external microcontroller. If required, the ISL94202 can also communicate with an external microcontroller via I2C serial bus to provide additional fuel gauge measurements, including state of charge and state of health information. Precise fuel gauge status is provided by the device's high-side current measurement feature.
The ISL94202 integrates high-side charge/discharge FET drive circuitry, which makes it easy to interface to tools or electric motor equipment. The device also controls external passive cell balancing switches to ensure good cell energy matching while protecting the pack's cell life from chronic undercharging. In addition, the ISL94202 can withstand factory pack assembly hot plug events, which greatly simplifies manufacturing.
"The ISL94202 offers customers all the necessary front end battery features to protect against catastrophic pack failure," said Philip Chesley, senior vice president of Precision Products at Intersil. "Its innovative high-side FET control, current monitoring and cell measurement delivers a small footprint solution for efficient battery pack designs."
Key features and specifications of the ISL94202
Eight cell voltage monitors support Li-ion CoO2, Li-ion Mn2O4, and Li-ion FePO4 battery chemistries
Highest level of integration: cell voltage level shift, automatic cell balance, 14-bit ADC, current sense monitor, power FET control, and temperature sensor interface
Stand-alone pack control, no microcontroller required
Multiple cell voltage protection options up to 4.8V
Programmable detection/recovery times for overvoltage, undervoltage, overcurrent and short circuit conditions
Configuration/calibration registers stored in EEPROM
Open battery connect detection
Integrated charge/discharge FET drive circuitry with built-in charge pump supports high-side N-channel FETs
Cell balancing uses external FETs with device's internal state machine or external microcontroller
Operates over the -40°C to +85°C industrial temperature range
Enters low power states when battery pack is not in use
The ISL94202 battery monitor is pin-compatible with the popular ISL94203 device that supports separate charge/discharge paths for higher-end 3-terminal battery packs. They are both part of Intersil's family of industrial battery management solutions, including the ISL94208 4-to-6 cell Li-ion battery management analog front end, and ISL94212 Li-ion battery manager IC, which supervises up to 12 series connected cells, and is cascadable up to 14 devices or 168

cells.

Cypress Unveils PSoC 6, the Industry's Lowest Power, Most Flexible MCU Architecture, Setting a New Standard for Battery-powered, Secure IoT Devices

Game-changing MCU Architecture Delivers a Dual-Core Processing Platform that Seamlessly Integrates Critical, Hardware-Based Security and Connectivity for the IoT

EMBEDDED WORLD, NUREMBERG, Cypress Semiconductor Corp. (NASDAQ: CY) today announced PSoC® 6, its newest microcontroller (MCU) architecture that is purpose-built for the Internet of Things (IoT). The architecture is built on ultra-low-power 40-nm process technology and delivers the industry's lowest power and most flexible solution, with integrated security features required for next-generation IoT devices. The architecture fills a gap in the IoT solution space between power-hungry and higher-cost application processors and performance-challenged, single-core MCUs. The dual-core ARM® Cortex®-M4 and Cortex®-M0+ architecture lets designers optimize for power and performance simultaneously. PSoC 6 enables engineers to uniquely create innovative, next-generation IoT devices leveraging the unique PSoC fabric with its easy-to-use, software-defined peripherals. More information on the PSoC 6 MCU architecture and access to the PSoC 6 Early Adopter Community is available at http://www.cypress.com/PSoC6.

"As the leader in wireless solutions for the IoT, we saw first-hand that our customers need a better processing solution that balances performance and power, while implementing critical security functions for connected devices," said Hassane El-Khoury, President and CEO at Cypress. "Our PSoC 6 MCU architecture is purpose-built to solve these problems, marking a significant addition to our broad embedded systems solution portfolio for the IoT."

Setting a New, Industry-leading, Ultra-Low-Power Benchmark

Cypress' proprietary ultra-low-power 40-nm SONOS process technology enables the PSoC 6 MCU architecture to feature industry-leading power consumption with 22 µA/MHz and 15 µA/MHz of active power on the ARM Cortex-M4 and Cortex-M0+ cores, respectively. With dynamic voltage and frequency scaling (DVFS), the PSoC 6 MCU architecture offers both performance- and power-critical processing capability. The dual-core architecture enables power-optimized system design where the auxiliary core can be used as an offload engine for power efficiency, allowing the main core to sleep.

Raising the Bar for IoT Security with a Trusted Solution

The PSoC 6 MCU architecture provides a hardware-based Trusted Execution Environment (TEE) with secure boot capability and integrated secure data storage to protect firmware, applications and secure assets such as cryptographic keys. PSoC 6 implements a broad set of industry-standard symmetric and asymmetric cryptographic algorithms, including Elliptical-Curve Cryptography (ECC), Advanced Encryption Standard (AES), and Secure Hash Algorithms (SHA 1,2,3) in an integrated hardware coprocessor designed to offload compute-intensive tasks. The architecture supports multiple, simultaneous secure environments without the need for external memories or secure elements, and offers scalable secure memory for multiple, independent user-defined security policies.

"Every connected device represents a potential network vulnerability. With billions of potential vulnerabilities, security is paramount and the need to design in security at the lowest level in an IoT device is more important than ever," said John Weil, vice president of the MCU Business Unit at Cypress. "We built PSoC 6 to enable our customers to protect their products from cyber-attacks while at the same time empowering them to create new, innovative IoT devices leveraging the flexible and easy-to-use PSoC architecture."

Enabling New, Innovative IoT Devices with Intuitive Software Support

Offering best-in-class flexibility and ease-of-use, the PSoC 6 MCU architecture can serve as the catalyst for differentiated, visionary IoT devices. Software-defined peripherals can be used to create custom analog front-ends (AFEs) or digital interfaces for innovative system components such as electronic-ink displays. The architecture offers flexible wireless connectivity options, including fully integrated Bluetooth Low Energy (BLE) 5.0. The PSoC 6 MCU architecture features the

latest generation of Cypress' industry-leading CapSense® capacitive-sensing technology, enabling modern touch and gesture-based interfaces that are robust and reliable. The architecture is supported by Cypress' PSoC Creator™ Integrated Design Environment (IDE) and the expansive ARM ecosystem.

Cypress at Embedded World 2017

Cypress, the leader in wireless solutions for the IoT, is demonstrating its full portfolio of IoT solutions for automotive, consumer and industrial markets here at the Embedded World trade show in hall 4A, stand 148 of the Nuremberg Exhibition Center from March 14-16.

Availability

PSoC 6 silicon, kits and software are currently sampling to select customers. More information is available via the PSoC 6 Early Adopter Program by registering at www.cypress.com/PSoC6. Full production is expected early in the fourth quarter of 2017.

Comprehensive Portfolio of Advanced Gigabit Ethernet Products Offers Ease of Design

A new portfolio of 48 Gigabit Ethernet chips featuring advanced capabilities, certified compliance, comprehensive software support and copy-ready evaluation tools is now available from Microchip Technology Inc. (NASDAQ: MCHP), a leading provider of microcontroller, mixed-signal, analog and Flash-IP solutions. The new suite of products, known together as GigEpack, aims to reduce complexity and remove barriers in deploying high-speed networks, opening up new uses and applications. The GigEpack includes the industry's first single-chip Gigabit Ethernet switches with integrated HSR/DLR redundancy for ultra-high reliability in critical manufacturing applications. Also included is the industry's first automotive-grade USB 3.1 Gen 1 to Gigabit Ethernet bridge which supports Advanced Driver Assistance Systems (ADAS) and infotainment systems on a variety of physical network layers.

The comprehensive portfolio of products, designed for industrial, automotive and consumer applications, includes three key elements that ensure ease of use and fast time to market. First, all products are UNH-IOL (University of New Hampshire InterOperability Laboratory) certified. Second, all products come with free software drivers that are certified or third-party approved for use with all major operating systems running on smartly engineered, copy-ready evaluation boards. Finally, the GigEpack suite is backed by Microchip's free LANCheck® online design service that reviews customer designs, ensuring that best design practices are used.

"With the introduction of the GigEpack, Microchip is offering a comprehensive platform of high-reliability Gigabit Ethernet products," says Mitch Obolsky, vice president of Microchip's USB and Networking division. "Our goal is to make these products readily available and easy to design. Our products, drivers, boards and documentation are freely available to every customer directly through our product Web pages."

The GigEpack suite of products includes three product families. The new KSZ9477/9567/9897 switch family includes features that allow users to create ultra-reliable networks with HSR/DLR redundancy and transport audio and video with Audio/Video Bridging (AVB). The KSZ9567 switch, for example, has seven ports, an SGMII interface and also features EtherSynch® technology, providing support for real-time Ethernet, IEEE 1588 v2 precision time protocol (PTP), AVB, and Time Sensitive Networking (TSN). The new LAN7800/LAN7850/LAN7801 bridge family enables customers to add Gigabit Ethernet to embedded processors via USB 3.1 Gen 1, USB 2.0 or High Speed Inter-Chip (HSIC) bridging to a variety of physical layers such as 1000Base-T, or 100Base-T1 and HDBaseT via RGMII. These products join Microchip's existing KSZ9031 family of Gigabit PHYs featuring automotive-grade robustness and low power consumption.

For more information about Microchip's GigEpack Gigabit Ethernet products, visit: www.microchip.com/GigEpack

Pricing and Availability

All products in the suite are available now for sampling or to purchase for volume production. The KSZ9477/9567/9897 switch products are available in TQFP packages starting at $6.07 USD per 10k units. The LAN7800/7850/7801 products are available in QFN packages starting at $3.65 USD per 10k units. The KSZ9031 PHY products are available in QFN

packages starting at $1.77 USD per 10k units.

For additional information, contact any Microchip sales representative or authorized worldwide distributor, or visit Microchip's website. To purchase products mentioned in this press release, go the new, easier to navigate and mobile-optimized microchipDIRECT or contact one of Microchip's authorized distribution partners.

STMicroelectronics Announces Volume Production of Industry-Unique Satellite Demodulator with Lead Customer Newtec

a global semiconductor leader serving customers across the spectrum of electronics applications, today announced the volume production of the world's first 500Mbaud High Symbol Rate (HSR) integrated tuner-demodulator chip, selected by its lead customer Newtec, a specialist in designing, developing, and manufacturing equipment and technologies for satellite communications.

Designed to increase bandwidth-usage efficiency and throughput in high-end satellite and hybrid broadband-broadcast applications, the STiD135 demodulator supports the DVB-S2, DVB-S2X, and DVB-S2 Annex-M[1] standards and is intended to complement terrestrial networks to provide a performance equivalent to fiber-optic links, taking advantage of the universal accessibility of satellite signals.

Newtec will use the STiD135 in its wideband VSAT modem portfolio. The Newtec MDM2210 IP Satellite Modem, which is the latest addition to the Newtec Dialog®multiservice platform, is the first-ever VSAT[2] modem on the market supporting 500Mbaud forward carriers with DVB-S2X.

"The long-term cooperation with our lead customer Newtec has now resulted in bringing the unique capabilities of our satellite demodulator to the market," said Jocelyne Garnier, Group VP, General Manager, Aerospace, Defense, and Legacy Division, STMicroelectronics. "When designing the chip, we took into account the market's demands and worked with many partners, including CNES, the French Space Agency."

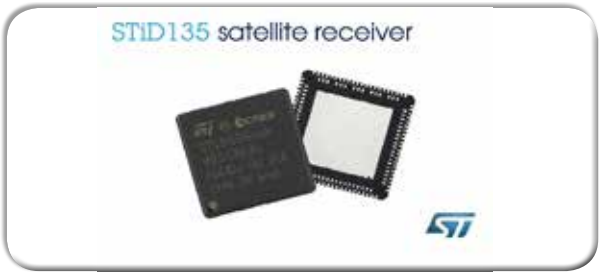
"We are delighted to cooperate with ST, which, as far as we are concerned, provides the only chip available on the market capable of handling such high rates, the likes of which are enabled by our new wideband modems," said Frederik Simoens, Chief Technology Officer at Newtec. "The cooperation will make our products the first on the market to support 500Mbaud forward carriers with DVB-S2X, guaranteeing our customers the highest performance and efficiencies."

The ST chip implements quad full-band tuners, dual HSR demodulators with up to eight narrow-band demodulators, and provides hardware support for Network Clock Recovery (NCR). It optimizes the use of Ka-band and multi-spot beam technology carried by the latest High-Throughput Satellites (HTS) by enabling single-carrier usage of these transponders. This delivers a 30% increase in channel efficiency over multi-carrier solutions.

The STiD135 is capable of demodulating two independent wide-band carriers and up to eight narrow-band carriers providing the capability to simultaneously receive high throughput data whilst receiving multiple broadcast channels, useful for example, in hybrid broadband-broadcast systems. The total useful data throughput is over 600Mbits per second, furthermore the on-chip data filtering ensures that only the wanted bits need be sent for further processing in the host system.

The design took into full account the demands of the market for low power and extended temperature range increasing the scope and application of the device to include out-door units, Smart LNBs, hybrid broadband-broadcast home gateways, VSAT terminals, small home-office modems, mobile platforms, data center modems, and so on.

The STiD135 demodulator chip is now in production and will be available for mass-market deployment by May 2017. Further information is available on www.ST.com and under NDA.



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